WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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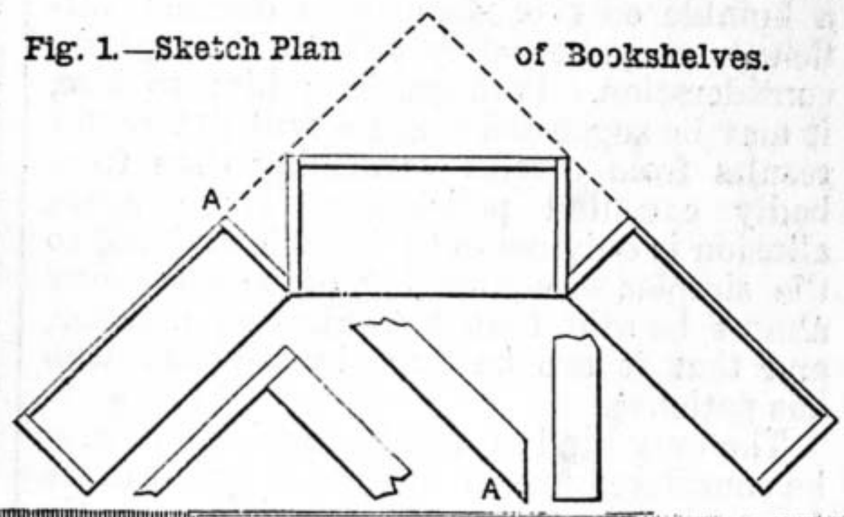
HANGING CORNER BOOKSHELVES IN PAINTED WOOD.

BY PALGRAVE MORRISON.

AN arrangement of bookshelves similar to the one illustrated had long been in my mind; one of its three component parts was made and in use, and the plans of the two others quite decided, when a room that I hoped to secure for my own snuggery should admit of their being placed in position. The novelty of the idea was fascinating to its inventor, and offered special advantages. My unexpected pleasure on going into a friend's rooms in one of the Cambridge colleges, and seeing the actual set hanging on his wall, provoked me to ask, How, when, and why the shelves in question were made? The reply showed that, as usual, circumstances unsightly in themselves had resulted in the distinct treatment. For in the room an old buttress jutted out in the angle of the wall, so that no ordinary corner cupboard would fit. This projection being unsightly was hidden in just the way I had planned for my own shelves.

Apart from any merit in the appearance of shelves so treated—and they are more picturesque than a simple rectangular group — the vacant space they leave in the angle itself would be admirable for a ventilating shaft, which, necessary and healthful though it be, is an unsightly object in a private room. It is often convenient to have a shaft placed in an angle against an outer wall, but since then no piece of furniture will fit the corner, it gives a desolate appearance to that part of the room. But a set of shelves in this fashion, whether fitted as bookshelves with or without glazed doors, and varied in all respects save the main features to suit the taste of its owner, would solve the difficulty.

Fig. 1.—Sketch Plan of Bookshelves.



It must be clearly indicated that the design offered is purely suggestive; it is not to scale; nor is the arrangement of any of its features a point to be insisted upon. The only structural feature to be followed is that the three separate carcases shall be shaped to form a symmetric group, thus making the whole more portable, saving wood; and more particularly avoid any complicated joinery at acute or obtuse angles.

As a reference to the plan will show, the triple bookcase thus grouped permits the central portion to be deeper, that is, to afford space for wider books, than the wings on either side.

That these wings should be the same height, and harmonise with the central part in their decoration and detail, however plain or elaborate that may be, is perhaps necessary. But that they should be of the same width is hardly needful, for it may easily happen that the obstacle of a door or window will make it more convenient to construct the two wings of different dimensions.

The depth of the side cases is intended to be about (not over) 6 in.; in other words, the uprights and shelves are worked from wood 5½ or 6 in. wide. This scale allows the shelves to be placed at intervals not exceeding 9 in. apart., with a certainty of containing any ordinarily shaped book comfortably.

The central division, being deeper, allows the shelves to be disposed so as to take volumes of larger size. Thus if the wings are 6 in. deep, the central part must be 8½ in. The sketch

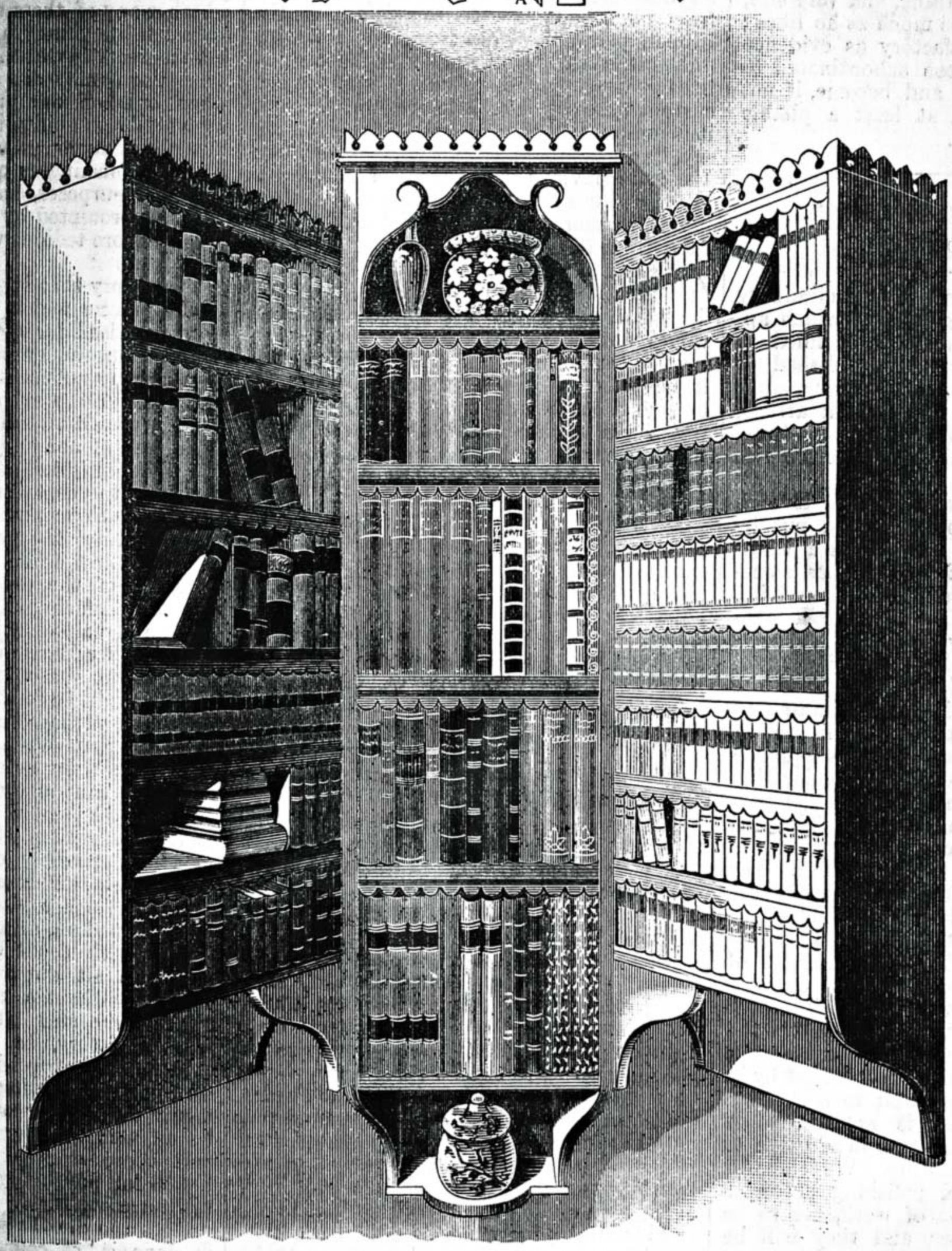


Fig. 2.—A Corner Bookshelf Fitting.

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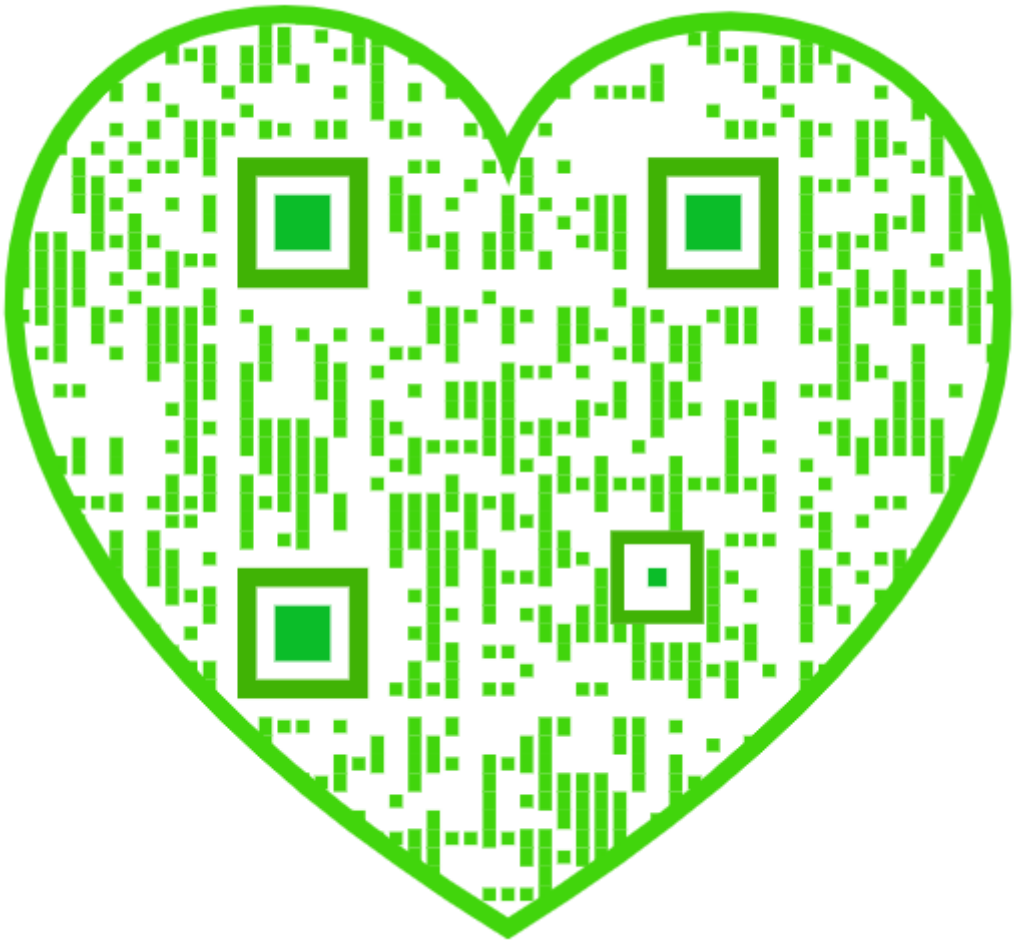

is in no way to scale; the general effect very fairly indicates the appearance of the complete structure.

The ornamental details to a set of shelves for books are best left out. The books themselves are the fittest decoration. But of course a slightly-pierced caging, as indicated, or a row of small turned spindles, may be used at top. So the top shelf of the central portion may be treated with an arch, leaving space for a bust or vase. The whole is intended to be painted or stained; merely a rough-and-ready set for a bachelor's study or professional man's use.

The edge of each wing where it touches the central part is bevelled away as shown in the diagram, so that it appears as if the whole were homogeneous, and not made up of three independent parts.

It is by no means necessary to have such shelves finished in black. I have a similar set finished in bright scarlet enamel, and another in peacock blue, that take their place in the room, and are not a bit staring or out of harmony with the rest; but then in each case the other things accord, so that it is best to recommend every would-be maker to be guided entirely by the future position of the finished thing, and vary size, colour, and decoration as much as he likes; for nothing is so satisfactory as evidence that the design has been subordinated to the needs of its owner, and become, if not an individual creation, at least a pliable adaptation in his hands.

MORE ABOUT POLISHING.

BY DAVID DENNING.

The novice who has read the "Preliminary Gossip about Polishing Wood," which appeared on page 506, may be inclined to ask whether wood should be polished or varnished, and, following up the answer which will be given in the present article, he will probably want to know something more about the distinction between the two methods of finishing.

Taking up the question which, it may fairly be supposed, would be first put by the tyro who has little more than a vague idea that wood, if not painted, has something put on it to make it shine and improve its appearance, some attempt at a satisfactory reply may be made. Perhaps, however, before doing so it will be as well just to understand what the action of any varnish is, without going into minute particulars. As is well known, varnish when applied is in a liquid state. This liquid is made up of a solvent for the particular kind of gum or resin used in making up the particular kind of varnish required. The surface of the work is coated or painted in some way with the prepared fluid. The moisture evaporates, leaving a film of the resin which has dissolved in it. Wood, or anything else so treated, is said to be varnished. Now, whether this method of finishing is suitable for woodwork depends on circumstances. For coarse work it does very well, but for articles of furniture the process known as French polishing is to be preferred, as finer results are to be got by it. It may, however, be as well to state here that French polishing is not the only method of finishing furniture in addition to varnishing, or even painting. We have, for example, oil and wax polishing processes which, for some kinds of work, are to be preferred to the other, and they will be treated of in due course.

Even choice articles of furniture, from the substantial sideboard to the flimsy fretwork ornament, may be varnished instead of polished; but it must be distinctly understood that a really well-finished surface cannot be got with the former process. This is tantamount to saying that any one who wants to finish a piece of furniture in a suitable and tradesmanlike manner must polish it, and not be contented with the simpler and easier process, which is also more expeditious it may be said, of varnishing it. Where to draw the line between the two classes of furniture, viz., that which will be worth taking some trouble about and polishing properly, and that for which a humble coat of varnish is deemed sufficient, may be safely left to the maker's consideration. Perhaps, as a hint to him, it may be suggested that he will get better results from careful varnishing than from badly executed polishing. There again allusion is only made to French, and not to the simpler wax polishing, of which it may almost be said that it requires no practice, and that it can be done by anybody who has patience.

The only kind of furniture which it may be considered proper to varnish is that made from pine, though even this is frequently French polished. Pine furniture, however, unless it is really well made and finished, is hardly worth polishing—at least, it is not customary to polish it. Like every other wood, it is undoubtedly improved, or, rather, let me say, its appearance is improved, by polishing; but it is obvious that the chief reason for pine furniture being its cheapness, varnishing is in many cases supposed to be good enough for it. The process of japanning, by which much of the cheaper kinds of pine furniture is finished, being akin to painting, does not now concern us, and I, for one, would not be sorry to see it extinct, or, to say the least, very much less employed than it is. The discussion of this is, however, beyond the scope of this series of articles, which will be confined to processes in which the grain or natural figuring of the wood is not hidden, but is simply brought out and improved by a transparent covering. Mahogany, walnut, and all the finer woods used in making furniture should be polished if they are to look as well as it is possible to make them. Enough has now been said to guide the novice in forming an opinion as to when he ought to finish by polishing, and to give him a clear idea of what this is. A little general explanation will be given, after which he will be better able to profit by the more detailed instructions which will follow.

Although the medium used to obtain a French polished surface is in reality nothing but a varnish, it is one of a much finer kind than is generally understood when the word "varnish" is concerned, and probably many of my technical experts may at once be inclined to exclaim that French polish, *i.e.*, the material used, is not a varnish. A moment's consideration, however, will show them that it cannot be described as anything else, and not only so, but that it cannot with accuracy be regarded in any other light. The material known as French polish, were it to be described fully, would be spoken of as a special varnish for French polishing. In colloquial language, however, both the finishing gloss and the material on which, or, perhaps, it will be as well to say by means of which, the gloss is produced, are spoken of as French polish. The material is nothing more nor less than the thin varnish which experience has shown to be the most suitable for producing a fine, smooth, glossy surface by the French mode of polishing. I daresay many of my readers have heard of the celebrated Vernis Martin, which means nothing more than Martin's Varnish, or, as we should perhaps now more elegantly call it, Martin's Polish. This Martin produced a very finely finished surface by means of some material or manipulation which he kept a secret, and which is said to have died with him. This, however, seems hardly probable, or, if his methods were not exactly known and followed, it is only reasonable to suppose that his success induced others in the same line of business to experiment on their own account, and that the result is what is now known to us as French polish. To say that this is exactly the same as the celebrated Vernis Martin is, of course, more than one can do. His materials may have been—indeed, probably were—different from ours. His mode of producing the gloss or polish, perhaps, bore a very slight resemblance to that now adopted; but that he made his reputation by smoothing or polishing a varnish can hardly be gainsaid. Many accounts purporting to describe his process have been given to the world, but it may be doubted whether any of them are absolutely correct, although they may approach very nearly, both as regards materials and manipulation. That the results are good when the somewhat cumbersome processes are followed with skill and ability is an undoubted fact; but the simpler process known to us as French polishing is quite sufficient for all practical purposes, and few, except those who are prompted by curiosity, will care to try any more tedious way of getting similar effects.

The theory that Martin was the inventor of the process which in a modified form is now practised for getting a gloss by mechanical means on a coating of suitable varnish may not meet with general acceptance, but those who urge it have at the least very substantial grounds to build on. This part of our subject is, however, more for the antiquarian than the practical polisher to consider; but even in the humblest of our pursuits it is often interesting to trace the process of development from the first crude idea to the improved processes of the present day. The dirty-fingered French polisher of to-day would likely not be exercising his craft if someone, whether Martin or not is of no consequence, had not observed that a varnished surface might be further improved by polishing. We, perhaps, are rather too apt to consider that when we know all about French polishing practically—that is to say, when we can do the work satisfactorily—everything has been learned. We go as far as the generation which immediately preceded us, possibly even surpass them, or think we do, and then rest satisfied that we have no further progress to make. We have learned all, or acquired all the knowledge which could be communicated, and forthwith sit down in complacent satisfaction, without a thought that improvements may still, at this period of the world's history, be practicable. "Well," says some enterprising polisher, "all this sort of thing, trying to find out improvements, making discoveries, and so on, may be all very well for engineers, electricians, and those engaged in scientific callings, but as for polishing, there is nothing more to be accomplished. That there are certain defects and drawbacks in the way the work is done is, of course, apparent; but then

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they cannot be avoided, and there is no way of overcoming them." Others again will tell us that they don't see anything the matter with their modes of working, which are quite good enough: they make a living by their work, and what more is requisite? Now, I am quite willing to admit that there may at present be no *known* way of overcoming some of the defects in polishing, but is there any reason why this should always be the case? At one time, and that not so very long ago, the average English polisher, or rather labourer who did the polishing, aspired to no higher gloss than was to be obtained by means of beeswax; and are we now to think that because a better finish can be got that there is nothing superior within the reach of man? True, at the present time we get a very nice surface, or, let me say, it can be got by a competent polisher, and in the foregoing remarks I have no wish to disparage the skill so often shown in finishing furniture; but with all deference to those who have arrived at the highest point of skill, there are defects which show that the craft has not yet attained to that degree of excellence which would warrant one in supposing that further progress cannot be made. Just to give one example of a weakness in the mode of polishing now pursued, let me suggest "sweating," which, as every polisher knows, is a frequent source of trouble and annoyance. It is all very well to say that "sweating"—by which, of course, I do not intend the commercial meaning of the word—is unavoidable, and to give all the reasons why newly French polished wood is liable to it. It may be admitted that with our present knowledge this is so; but is it inconceivable that some improvement might be made which would render "sweating" a thing of the past? I am quite aware that experiments have been made with this intention, and that some of them have been attended with a fair amount of success; but still, the argument remains good that there is still plenty of room for improvement in the details of the work, and it is with a view to stimulating those who are best able to make improvements, viz., those who are professional French polishers, to investigations on their own account that these suggestions are offered. Perhaps it may be thought that after having referred to "sweating" I have some specific against it, or that I have ideas of what ought to be done to prevent it. I am sorry to say I have no remedy to suggest, but it by no means follows that there is none to be discovered. Of course, "sweating" is only named as an example, but other matters in which there is room for improvement will occur to any practical polisher. I know many of these are inclined to regard with suspicion anything claiming to be improvements, but I cannot help thinking that advances might be made by polishers themselves which would be of benefit to the craft, and that those whose experience has shown them how improvements are practicable have a splendid opportunity of disseminating their views in the pages of this magazine. They may be sure that plenty among the readers would try their methods and discuss them; not amateurs merely—for, with all due deference to these enthusiastic workers, they are unable to do so fully—but artisans who have a thorough knowledge of the difficulties to be overcome, and are both willing and competent to adopt any improvement. Perhaps much of the stagnation—which, after all, may be more apparent than real—which exists in minor trades is owing to the fact that, till the appearance of WORK, the means of communication of ideas have been very limited in extent. Trade organs or journals devoting themselves to our particular trade have appealed more to the employer of labour than to the artisan himself. In WORK exists a real workman's magazine, or I would not have ventured to make the digressions I have, and while the amateurs' wants are by no means disregarded, the professional is encouraged to go ahead and let the world benefit by the hints and wrinkles which he has picked up, but which have hitherto seldom got further than his workshop. That there is a vast accumulation of "folk lore" lying almost buried, must be evident to every one who has been much in factories or workshops of any kind, and though in succeeding papers I hope to communicate a general idea of how to wax, oil, or French polish, I can only state what has come under my own observation. As has been stated before, the instructions will at the least explain to amateurs and novices what they ought to do, while those more advanced may find suggestions which will lead to increased skill on their part.

IRON AND STEEL: ITS ANALYSIS.

BY CHEMICUS.

DETERMINATION OF SILICON, SULPHUR, AND PHOSPHORUS.

THIS article is written with the object of enabling those of our readers who possess a knowledge of practical quantitative analyses to make a determination of the silicon, sulphur, phosphorus, manganese, combined and graphitic carbon, copper, etc., in iron and steel. Unquestionably the information afforded by such an analysis is of considerable value, as from it we are enabled, not only to decide as to the suitability or otherwise of the metal for any purpose, but also to account, to a certain extent, for any abnormal behaviour in the same when subjected to mechanical treatment.

For the analysis the sample of iron or steel is brought, preferably, into a state of drillings. This, however, in all instances, is not possible; when such is the case, the sample is reduced to as fine a powder as possible.

SILICON.

When iron or steel is dissolved in nitro-hydrochloric acid, the iron enters into solution as ferric chloride, while the silicon is oxidised into silica (SiO_2), which, by subsequent evaporation of the solution to complete dryness and heating of the residue, is rendered insoluble. Such is the principle upon which the determination of silicon is based.

For the analysis, weigh out four grammes of the sample and dissolve it, with the aid of a gentle heat, in 100 cubic centimetres of nitro-hydrochloric acid* in a porcelain dish of about 500 cubic centimetres' capacity, the mouth of which is covered with a watch glass to prevent loss by spurting. (As regards the actual quantities of the metal taken for the determination of the several constituents, the operator must use his own judgment, being guided by the quantities of the same presumably present.) When completely dissolved, remove the watch glass, after washing any liquid adhering to the same into the dish, cautiously take the solution to complete dryness, and strongly heat, over a Bunsen burner, the resulting residue until it becomes black. Add to the contents of the dish, when cool, 100 cubic centimetres of hydrochloric acid, heat gently to bring into solution, and again take to complete dryness. Make a further addition of hydrochloric acid, and evaporate until a crust commences to form upon the surface of the solution, which dissolve in a few drops of hydrochloric acid. This solution is now diluted with a somewhat large volume of warm water and passed through an English filter paper which retains the silica, or, if an iron be under analysis, a mixture of silica and graphitic carbon, or graphite.* (Invariably small portions of the silica adhere to the sides of the dish, the removal of which is effected by rubbing the same with a "policeman"—a piece of caoutchouc tubing at the end of a glass rod—and rinsing into the filter.) Wash the filter, together with contents, with a hot dilute solution of hydrochloric acid some half dozen times—one acid to three parts water—and afterwards with hot water until the washings give no red coloration with a dilute solution of potassium ferricyanide.

The subsequent treatment of the filter and contents depends upon whether a steel or an iron be under analysis. Should the sample be a steel, the filter and contents are placed in a platinum crucible and ignited, employing at first a low temperature, but gradually increasing to a bright red heat, allowed to cool under the desiccator, and the weight † of the silica, which contains 46·67 per cent. of silicon, determined. If, however, an iron be under analysis, the filter, etc., contained in a platinum crucible is ignited at a heat just sufficient to burn off the paper (the employment of a high temperature must be carefully avoided, as it would result in a loss of graphite), and when this is effected the residual graphite and silica weighed, replaced in the crucible, and again ignited, this time employing a strong red heat, whereby the graphite is burnt off. Finally the weight of the residue (silica) is determined, which weight, as is obvious, deducted from that of the graphite and silica, will equal the graphite contained in the weight of the metal taken for analysis.

The silicon may also be determined by the following method:—Four grammes of the sample, contained in a beaker, are dissolved, with the aid of a gentle heat, in 100 cubic centimetres of dilute sulphuric acid—one part acid to three water—and the resulting solution evaporated until it becomes a white cakey mass (ferrous sulphate), and heavy white fumes are given off. When the beaker and contents are cool, add 250 cubic centimetres of water and heat to boiling, with constant stirring, until the mass of ferrous sulphate has dissolved. The silica and graphite, if the same be present in the metal, are then collected on a filter, washed, etc., as previously described.

The silicas obtained by the above methods should be white, but not unfrequently they are more or less red, due to the presence of iron, which even repeated digestions with hydrochloric acid fails to eliminate. The whiteness of a silica is not, however, a guarantee that it is pure, as, although free from iron, it may nevertheless contain titanium, should the same be present in the iron or steel. To obtain the silica in a state of purity, it is intimately mixed, contained in a platinum crucible, with six times its weight of acid potassium sulphate, and fused, employing

* Prepared by mixing one part nitric acid (sp. gr. 1·42) with three parts hydrochloric acid. It is advisable to prepare a large quantity of this reagent, as it is employed throughout the analysis.

* Steel, practically, contains no graphite.

† The weight of the filter paper ash must always be deducted from that of the precipitates, etc.

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at first a low temperature, but gradually increasing to a bright red heat. At the expiration of thirty minutes allow the crucible to cool, remove the lid, and break up the fused mass as completely as possible, then, together with the lid, place in a dish and digest, with constant stirring, with cold water for a considerable time. Withdraw the crucible, etc., after washing, and collect the silica, now pure, on a filter, wash, etc.

SULPHUR.

The methods employed for the determination of this constituent are based upon two principles, viz:—

(*a*) When iron or steel containing sulphur is dissolved in nitro-hydrochloric acid, the sulphur is oxidised into sulphuric acid, which is precipitated as barium sulphate ($BaSO_4$), by barium chloride.

(*b*) Upon passing the sulphuretted hydrogen evolved upon dissolving the metal in sulphuric or hydrochloric acid through a solution of a metallic salt, such as copper sulphate, the sulphur combines with the metal, resulting in the precipitation of a metallic sulphide.

Of the two methods, that founded on principle *a* is the most accurate, but *b* method is the most rapid, and furnishes results which for general purposes are sufficiently accurate.

In determining the sulphur by *a* method, two or four grammes of the sample, according to the amount of sulphur presumably present, contained in a porcelain dish, are dissolved in 100 cubic centimetres of nitro-hydrochloric acid, the resulting solution taken to complete dryness, and the dry mass heated strongly. Allow the dish and contents to cool, and bring the dry residue into solution by the addition of 100 cubic centimetres of hydrochloric acid and the application of a gentle heat. Take the resulting solution to dryness, re-dissolve in hydrochloric acid, evaporate until a crust commences to form upon the surface of the solution, which dissolve by the addition of a few drops of hydrochloric acid. The solution is now diluted with hot water and passed through a filter, which retains the silica, etc., while the filtrate contains the sulphur in solution as sulphuric acid. If the above directions have been carried out the filtrate will be free from nitric acid, and, also, from an excess of hydrochloric acid; two very necessary conditions for the obtainment of accurate results; the former because nitrates are precipitated by barium chloride, and the latter on account of barium sulphate being soluble in acid solutions of ferric chloride. Make up the filtrate, after separation of the silica, with water to a volume measuring 500 cubic centimetres,* add five cubic centimetres of a solution of barium chloride—prepared by dissolving one part of the crystals in ten of water—well mix the liquids, cover the mouth of the containing vessel—preferably a large beaker—and allow to stand at rest in a warm place. After the lapse of at least twenty-four hours, decant off as much as possible of the supernatant liquid, and pass the remainder, together with the precipitated barium sulphate, on to a Swedish filter paper. Wash contents of filter some three or four times with a dilute solution of hydrochloric acid—one acid to six parts water—and thoroughly cleanse with water, then transfer to a platinum crucible, ignite at a strong heat, and when cool determine the weight of the barium sulphate, every hundred parts of which is equivalent to 13·37 of sulphur.

The determination of the sulphur by the method based on principle *b* necessitates the employment of a solution of a metallic salt. A solution of copper sulphate may be employed, which is prepared by dissolving sixty grammes of the crystals in a litre of water.

For the analysis weigh out into the flask, A (Fig. 1), which has a tube, C, bent at right angles welded to the neck, ten grammes of the sample, and insert the caoutchouc cork, through which the safety acid funnel, B, passes, reaching to near the bottom of the flask. Arrange the apparatus over a Bunsen burner, so that the tube, C, dips to a considerable depth beneath the surface of the copper sulphate solution contained in cylinder, D. (D contains 200 cubic centimetres of the copper sulphate solution.) About 200 cubic centimetres of dilute

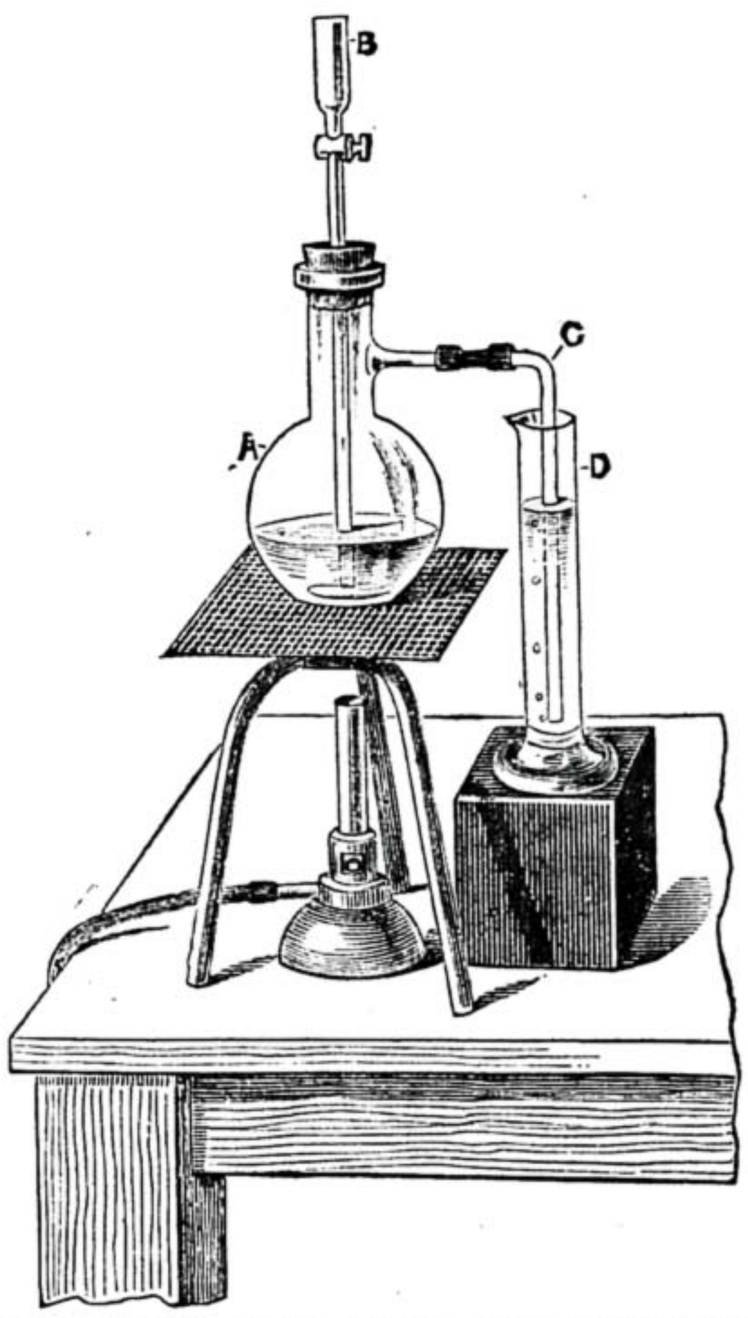

Fig. 1.—Arrangement for Determining Sulphur in Analysis of Iron—A, Flask; B, Safety Acid Funnel; C, Bent Tube; D, Cylinder containing Copper Sulphate Solution.

sulphuric acid—one part acid to three water—are now passed into the flask through the funnel, B; the metal is immediately attacked, sulphuretted hydrogen being evolved, which as it escapes and passes through the copper sulphate solution is decomposed into sulphur and hydrogen, the former combining with the copper, resulting in the precipitation of copper sulphide, while the hydrogen escapes. Towards the end of the operation apply a gentle heat, and when the evolution of gas ceases fill up the flask with warm water, taking care that none be allowed to overflow into D, whereby the whole of the gas is driven over. Then withdraw the flask, washing any of the copper sulphide adhering to C back into the cylinder, and pass the contents of cylinder through a filter. Well wash the copper sulphide on the filter with cold water, then transfer to a porcelain crucible, and convert, by ignition, the sulphide into oxide of copper (CuO), and weigh. Every hundred parts of copper oxide is equivalent to 20·12 of sulphur.

PHOSPHORUS.

The methods of determining this element are far from satisfactory, but that known as the "molybdate" process yields, in our opinion, the best results. The method is based upon the principle that when iron or steel is dissolved in nitro-hydrochloric acid, the phosphorus is oxidised into phosphoric acid, which is precipitated by ammonium molybdate.

For the analysis, take four grammes of the iron or steel, or less should the sample be phosphoric, dissolve in nitro-hydrochloric acid, and separate the silicon as already described. The filtrate will contain the phosphorus as phosphoric acid, but before the precipitation can be proceeded with, the hydrochloric acid must be expelled. With this object the solution, contained in a conical, is mixed with 100 cubic centimetres of nitric acid (sp. gr. 1·42), and evaporated until it acquires a thick syrupy condition. Repeat this evaporation with nitric acid some three or four times. Finally, to the syrupy mass add sufficient nitric acid to cause it to flow freely in the containing vessel, and to the resulting solution, which should occupy a volume measuring not more than 50 cubic centimetres, add 50 cubic centimetres of the ammonium molybdate solution. Thoroughly mix the liquids by agitating briskly the containing vessel, and then allow to stand at rest in a warm place (about 40° C.) for five minutes. After the lapse of this period, ascertain, by smell, whether the solution is ammoniacal or acid, and if the former add strong nitric in small quantities at the time, agitating well and allowing to stand at rest, with each addition, until only slightly acid,* while if acid add ammonia until slightly so. Upon the obtainment of the right degree of acidity, allow the solution to stand until the yellow precipitate of ammonium phospho-molybdate has settled to the bottom of the containing vessel and the supernatant liquid is clear. Collect precipitate on a tared Swedish filter paper, employing a dilute solution of nitric acid—one acid to five water—to rinse on the last portions, and wash filter and contents some half dozen times with the dilute acid. Finally remove filter paper, etc., to the water oven; dry and re-weigh to determine increase due to phospho-molybdate precipitate, which contains 1·66 per cent. of phosphorus.

The ammonium molybdate solution is prepared by dissolving fifty grammes of the crystals in a litre of water, adding sixty cubic centimetres of ammonia (sp. gr. ·88), and allowing the solution to stand for two or three days and decanting from any precipitate formed.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

MARKING OFF, OR PREPARING BRIDGES TO RECEIVE THE STRINGS—VARNISHING SOUNDBOARD, ETC.

IN the two previous papers I dealt with the construction of the back and sound-board. I must now advance another stage and show how the bridges are prepared to receive the strings, or what is technically termed marking off (Fig. 1).

In a pianoforte factory the business of the marker-off is to take the back, with the

* This solution must be distinctly acid, but free from an excess.

* The successful precipitation lies in the obtainment of the right degree of acidity. What this is cannot be very well defined. It is such, however, that while there is a sufficient quantity of acid present to prevent the precipitation of ammonium molybdate, there is not a large excess, which would prevent complete precipitation of the phosphorus.

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sound-board in position, and to plane the bridges to their proper height, mark the scale, drill and pin the bridges, clean and varnish the sound-board, adjust the bottom and bent side plates, bore the wrest plank, and put in screws and bolts. I will describe as clearly as I can how this is done. See that the bass bars do not touch the bottom of the back; if they do so, take a chisel and cut the wood of the back away until they are fully free. To test whether it is free, strike the long bridge in the centre

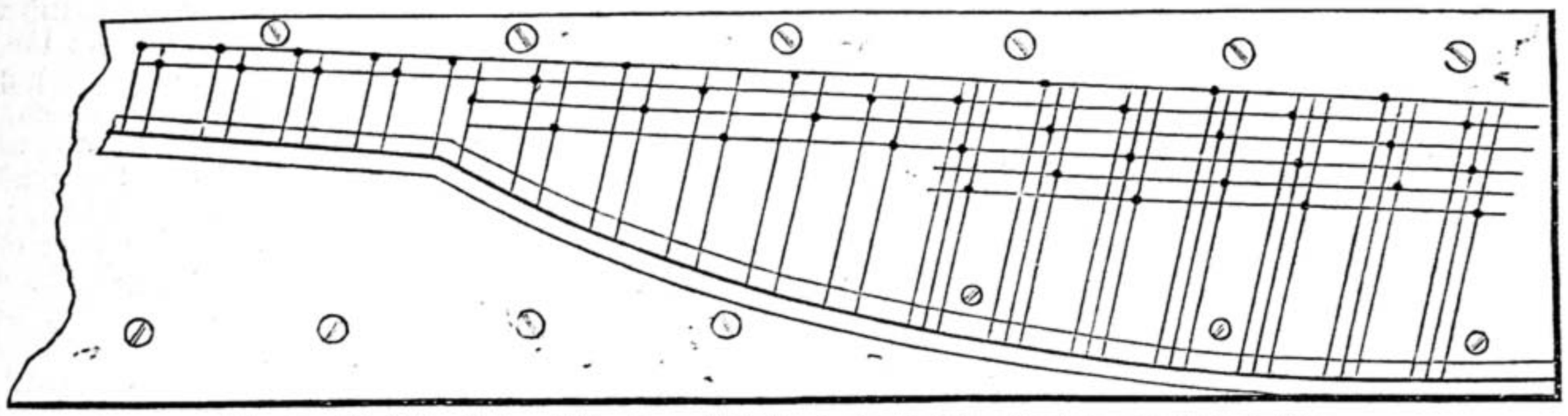


Fig. 1.—Sketch of Wrest Plank and Method adopted for Marking for Wrest Pins.

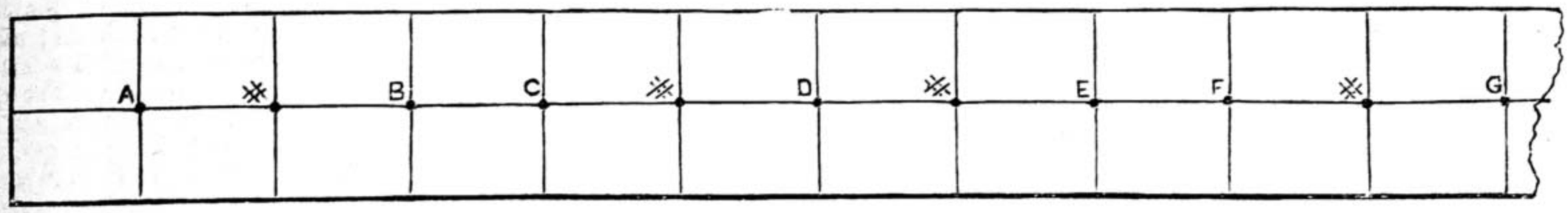


Fig. 2.—Scale for Marking Bridges: actual size.

with the clenched hand, and it ought to sound like a drum. Now prepare a slip of pine $\frac{3}{4}$ in. wide and $\frac{1}{2}$ in. in thickness; this is to be placed round the edge of the bent side on the sound-board, the $\frac{1}{2}$ in. edge to be glued on the sound-board, and close up to the bent side. To bend this, you may find it necessary to cut some kerfs in with your saw, then put some pins in, to hold it in position until the glue dries. Plane your top or wrest-plank bridges down to $\frac{3}{8}$ in. at the treble, and $\frac{1}{16}$ of an inch lower at the bass end. Now make it straight in its length, and plane the bent side slip down to $\frac{3}{8}$ in. at the treble, graduating to $\frac{1}{8}$ of an inch at the bottom of the bent side. Now place the bottom plate on temporarily, securing it with a hand screw; see that the bottom of the sound-board does not touch it. Take a straight-edge and hold it on the plank and long bridges at the treble end, and you will find that your long bridge requires reducing in height; plane it down about 12 in. of its length until your straight-edge is within $\frac{1}{8}$ of an inch from the bent side slip, then move your straight-edge 12 in. nearer the bass, and plane down until it is $\frac{1}{4}$ of an inch; move another 6 in. and make $\frac{3}{8}$ of an inch. Now from this point graduate the slip to the bottom plate. Now place the straight-edge across the bottom end of the long bridge, and make it, and also the beginning of the short bridge, $\frac{3}{8}$ in. above the plate, graduating to $\frac{1}{4}$ in. above the plate at the extreme bass end. The reason for planing the bridges is that the strings shall have a proper down-bearing, as, no doubt, you have observed the bridge of a violin supporting the strings in the same way.

If the sound-board sinks or the strings lose this bearing, the piano loses its beauty of tone, also making it very thin in power. Now make two slips of wood about $\frac{1}{4}$ in. in thickness, and $\frac{3}{4}$ in. wide, 4 ft. 2 in. long; make them clean on one side; mark one slip top and the other bottom. Gauge a line in the centre of each slip; now take the top slip and mark a line across with a square and marking point $2\frac{1}{2}$ in. from the end, and mark this treble. Now set your compasses to $\frac{9}{16}$ of an inch; start from the mark you have made, and proceed to mark the length of the slip until there are eighty-five marks on it, the space between each being $\frac{9}{16}$ of an inch. Square the marks across, and mark the bottom slip. Make the first mark $1\frac{1}{2}$ in. from the end, and mark it treble. Now serve it the same as the top one, with the exception of the last twenty-seven marks at the bass end; these must be contracted or drawn in, so that they are 1 in. shorter in their space than the twenty-seven in the top scale. This can easily be done by closing the compasses hardly $\frac{1}{16}$ of an inch. Having done this, bore a $\frac{1}{16}$-in. hole with a drill in the gauge line crossing each mark. For convenience it would be as well to mark each note in the following order from the bass end (you can do it with pen and ink): A *, B, C *, D *, E, F *, G (Fig. 2); and continue in the same manner until you get to the treble end of your slips, where you ought to finish with A. Place the top slip under the wrest plank, so that your first note, A, will be $2\frac{1}{2}$ in. from the treble, or right-hand side of your back. Now place the bottom slip at the bottom of back crossing the bent side; fix these temporarily so that they will not move about. The bottom slip will be $1\frac{1}{2}$ in. from the treble end to the first note. Place a piece of wire in the two first holes, and having a stick of black-lead pencil, flattened one side, so that it rests close to the straight-edge, put your straight-edge up to the pins at top and bottom, and mark across the bent side and both bridges; continue this until you pass the bent side, then, of course, take your lines across the bridges. Now set your compasses to $\frac{1}{4}$ of an inch wide, and use them as a gauge; run round both sides of the long bridge, making a mark on the top; also run them round top bridge from bottom side (Fig. 3); now open them $\frac{1}{16}$ of an inch wider, and mark both sides of the short bridge. Now you will have to make a tool as shown in Fig. 5. This can easily be made out of a piece of round steel; flatten one end, and make the prongs with a saw file; the one with the three prongs is for the trichord notes, and the two prongs for the bichord

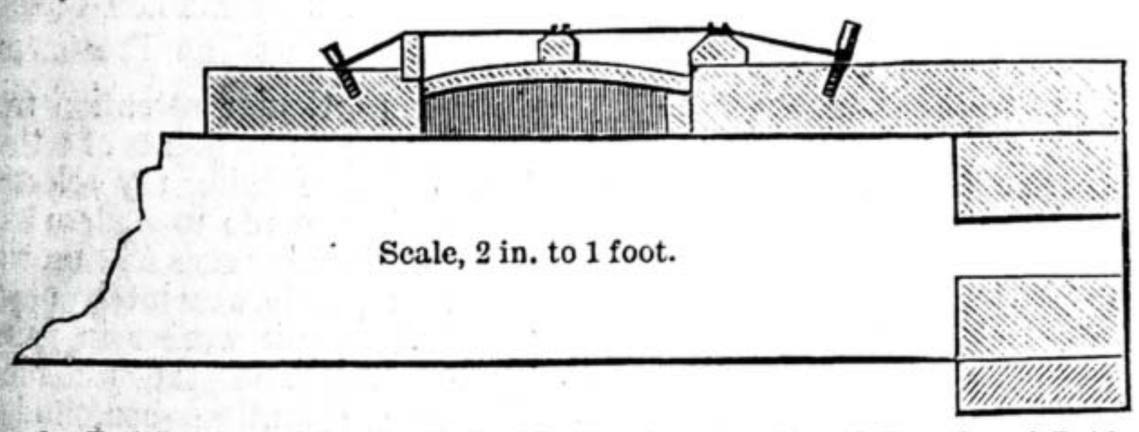


Fig. 4.—End Section of Treble End of Back, showing Sound-Board and Bridges.

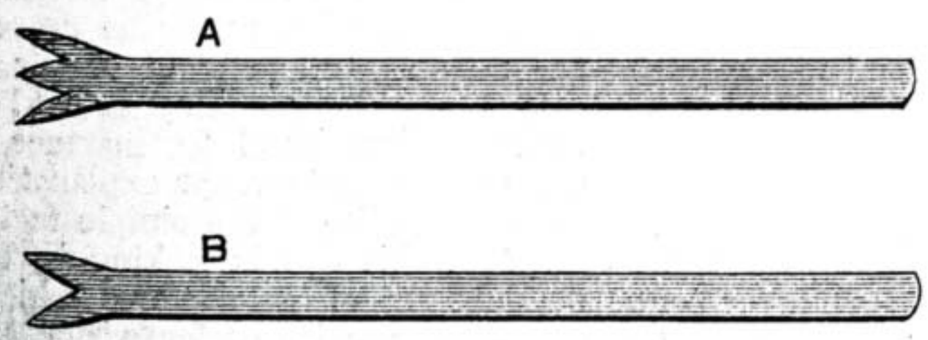
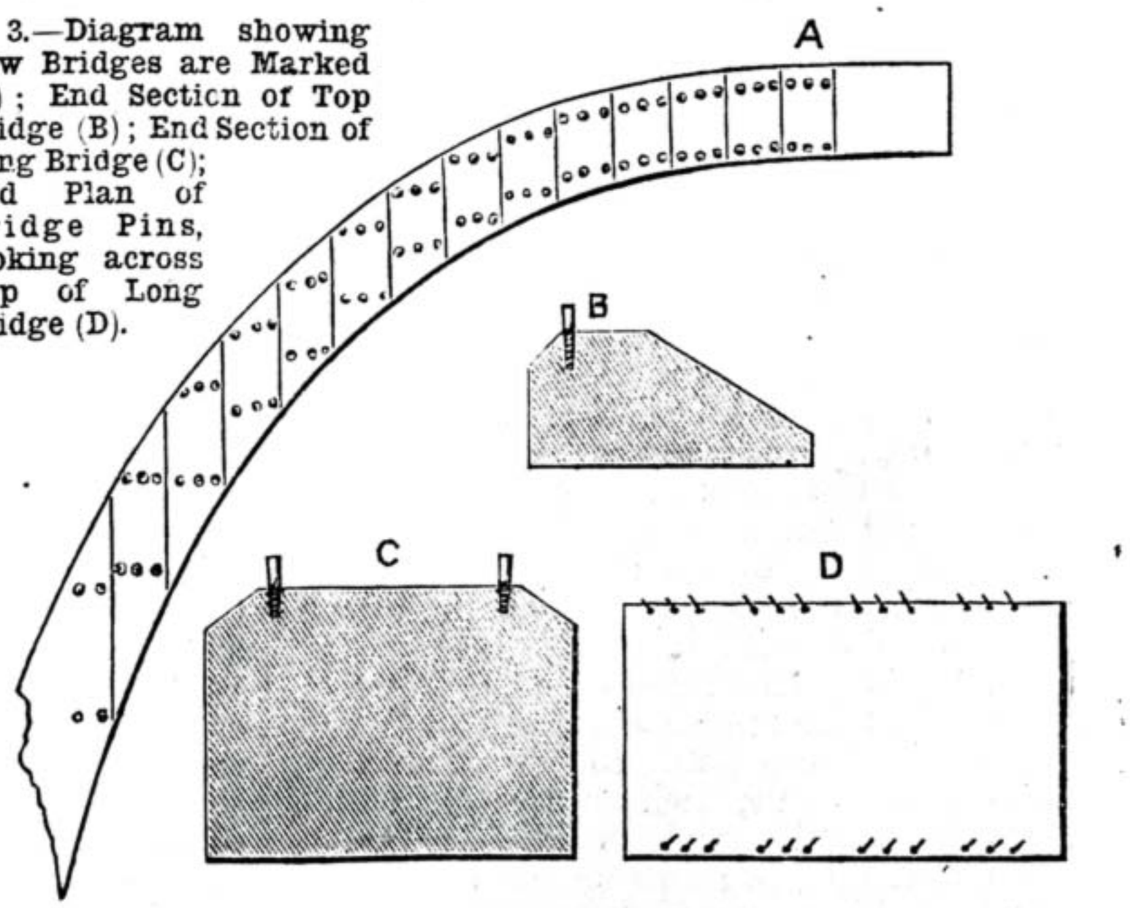


Fig. 5.—Forks for Marking for Bridge Pins: actual size. A, Trichord; B, Bichord.

Fig. 3.—Diagram showing how Bridges are Marked (A); End Section of Top Bridge (B); End Section of Long Bridge (C); and Plan of Bridge Pins, looking across Top of Long Bridge (D).



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notes. Now take your trichord punch, and place one prong on the first treble line of your top or wrest-plank bridge, the other two prongs being to the left of the line. Punch each one in this way until you have done twenty-two, this will be the number of trichord notes. Now take your bichord punch and punch the remainder with the exception of the last seven at the bass end; these are single notes, so only require one punch mark. You now mark the long bridges. Take the trichord punch and begin with the first note at the treble; place the right prong on the line which crosses the bridge, and the left on the line you made with the compasses, holding the punch in a line parallel with the wrest plank.

You will find that the first twelve notes will run in a line on the bridges, when they will gradually break off. Mark twenty-two with the trichord punch. In the top bridge there is one line of pins, in the long and short bridges there are two lines of pins; now to mark the bottom edge of the bridge, place the right prong on the line you made with the compasses and the left prong parallel with the wrest plank. Of course you mark with the bichord punch to correspond with the top bridge. You may now mark the short bridge with the bichord punch in the line you made with the compasses, except the last seven, which are single notes; serve these the same as the top bridges.

In the trichord you use small bridge pins, bichord middle size, while for the short bridge you use a shade larger. You ought to have your pins before you bore the holes, which is done with a drill stock and bow, or an Archimedean drill will answer your purpose, and are about 2s. each. You can make your drills out of umbrella steel ribs; if they are round, file them so that they have three sides to cut with, which will prevent splitting.

Commence boring the top bridge, using soap on your bit; start at the treble; you can sit on the wrest plank while boring this, and hold your drill in a slanting direction, so that your pins will lean towards the bass. Now bore the long bridge, the top row bore leaning towards the bass, and the bottom row leaning towards the treble; serve the short bridge in the same way.

Having bored all your holes in your bridges, scrape your bridges clean and glass-paper them. Now mix some black lead into a paste with water, and rub with a piece of flannel over the surfaces of the bridges; now rub a piece of round steel over and burnish them. Set your compasses to $\frac{9}{16}$ of an inch; run round the top bridge, using them as a gauge, that will give you a line to work to. Now take a small plane and bevel the bottom edge of the bridge up to the pin holes. Bevel the top side of the bridge up to the line you previously made with the compasses, smooth it well, then varnish with a small brush. Now bevel the bottom edge of the long bridge up to the first hole; also bevel the top treble edge, where the holes run straight; then take a small saw, such as are sold with a brass back and straight handle for 1s. 6d., or a dovetail saw; now sit on the sound-board, looking towards the wrest plank, and begin at the treble end at the thirteenth hole. Hold your saw, and cut in the same direction; your strings will lie across the bridges $\frac{1}{8}$ of an inch the bass side of the hole, down to the hole of the note below, about $\frac{1}{4}$ of an inch deep. You will find these cuts will lengthen as you get down the bridge. After you have cut them all, then take a sharp $\frac{3}{4}$-in. chisel, and hold it half way across the holes and cut the piece out, starting at the treble and going to the end; this is called carving the bridges, and if done carefully looks very nice; see that you clean the side (that you cut with the saw) with the chisel. The short bridge you simply bevel up to the pin holes at the top and bottom edge.

You must now make a bevel in the following manner: take two pieces of $\frac{1}{2}$-in. pine, one piece $1\frac{1}{2}$ in. wide, and the other 1 in. wide, and both 9 in. long. Screw the 1-in. piece across the centre of the other $\frac{1}{8}$th to the inch out of square. Now start at the first treble hole on the top bridge, holding your bevel to the holes in rotation, and marking with a fine pencil across the wrest plank. This is done to mark for the wrest or tuning pins. Where it is trichord, mark a straight line 2 in. from the top of wrest plank, and 5 more below it, with a space of $\frac{5}{8}$ in. between each line. Where it is bichord, you will only require four lines; see that the bottom row of pins are $4\frac{1}{4}$ in. at this point from the top bridge. This is so that the action will have room later on. Take a centre punch, and start at the treble, and punch the first, third, and fifth lines from the bottom; this will be your first note. Now punch the second note; that will be on the second, fourth, and sixth lines. As the grain of the wood in the wrest plank runs straight, this is done to distribute the pins over as large an area as possible. When you come to the bichord, you punch the first and third line for one note, and the second and fourth for the following, repeating it as you proceed. By a little close observation, you will soon see how this is done. Now clean the pencil lines off with a scraper and glass-paper, and give three coats of white hard varnish, allowing each coat to dry before the other is applied. You then clean up the sound-board, and give three coats of varnish.

Next we must turn our attention to the bent side. Run a pencil line round the bent side from the sound-board edge 2 in. From this line, mark towards the treble in short lines parallel with wrest plank across the straight lines previously made, every four until you have marked across thirty-eight lines. Now punch a mark where the lines cross. As you have twenty-two notes trichord in the treble, count this number, and 1 in. behind them make another line, and punch. You can now clean the pencil lines off. Now take a sheet of brown paper, and cut to fit round the inside of slip of bent side, and extend an inch over the holes you have punched. Mark where it crosses each bracing for bolts; get a heel-ball from a shoemaker's, and rub over the brown paper, and this will mark all your holes. This is a pattern for an iron plate to cover the bent side to prevent splitting. You will require to send this to the ironmonger's before mentioned, and order the bridge pins, Nos. 14, 15, and 16, one set and twenty-five over of wrest pins, nine wrest-plank screws and washers, and four 6-in. bolts with nuts, square heads, and sixty hitch pins for bent sides. I have not mentioned screws, as these are generally to be had in most towns, and they are not of a special character.

When you have got your pins, you will know the size to bore the holes; let the bridge pins fit the holes, but not tight enough to split. It is better to bore in a piece of beech till you get your bit the size you require. The wrest pins must fit tight as in tuning; if they were not so, the piano would not stand in tune. Having got your holes bored in your bridges, proceed to pin them (using a small hammer for the purpose); let them stand above the bridges about $\frac{1}{8}$ of an inch, then run over with a file to level them. In boring the wrest plank, use a stock, and probably you will find a $\frac{3}{16}$-in. spoon bit will be the size. You must bore these, standing at top of the wrest plank when the back is on the trestles, and let the bit lean towards you, so that the wrest pin is $\frac{1}{4}$ of an inch out of the upright in its length; this prevents a tendency to fall down, as when the piano is on its bottom, the pins point upward a trifle. Having bored the holes, countersink a little to remove burr off the top. Now mark above the holes the scale you marked on the rods, beginning at bass end, and starting with A and ending with A.

The bent side plate must now be put on so that the holes cover the punch marks; screw on, and put bolts through so that they are level at the back; you can bore in the bracing with a centre-bit for the nut to lie on; now bore your holes for your pins with a small bit, and drive in the bent side. Fix on your bottom plate, put in position by loeping a piece of string on the last pin, and see that it comes in a direct line to the bridge. Now hold in position with hand screw, and put 2-in. screws in the projections, and 6-in. bolts in the bottom into the bracings. To find the place for the nut, turn it on the bolt half an inch, then hold it on the bracing opposite to the hole you want it to go in, and strike the nut with a hammer. Now bore a 1-in. centre-bit hole in a little way, and bore through the hole in your plate to meet it, then drop your nut in the hole, and turn your bolt in. Now put some 4-in. screws through the wrest-plank under the top bridge in the bass and over in the treble into the bracings; this will secure your wrest plank at the bottom edge.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

THE THREE SIMPLE DIVISIONS OF COLOUR —SECONDARY AND TERTIARY PIGMENTS.

I WILL now ask particular attention from the young worker on a few points of a theoretical nature, before I bring my selection of house-painters' pigments to a close with a list of the most useful greens and browns.

In the first place, it is absolutely necessary that the student and worker in paints should clearly understand the difference between the two, oftentimes-confounded, terms of *pigments* and *colours*. Colour is but a *sensation* conveyed to the brain by the action of light upon the nerve-fibres of the retina. Independent of our eye-sight, colour, literally speaking, is not! When a man is colour-blind, for instance, either to red or green colour, the explanation of this phenomena lies in the simple fact that the retina of his eye is lacking in that independent set of nerve-fibres which, in the case of those with perfect vision, answers to the particular sensations of red or green conveyed to them by light. The blue of the sky, the glorious, golden hues of sunset, and the beauteous and sight-comforting greens which clothe the forms of vegetation, these colour sensations are individually and collectively due to the same source of reflected and transmitted light, acting in concert with the wondrous attributes of our vision.

Pigments, on the other hand, are those

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substances which, when acted upon by light, absorb certain of the rays of colour therein contained, and, by either reflection or transmission, give forth that particular colour by which, as blue, red, green, and so on, they are known. It will, therefore, readily be seen by every reader that this is not in any way a distinction of terms only, but as much a difference as there is between "substance and shadow."

In the more advanced divisions of my subject it will be at once my pleasure and privilege to further practically consider the nature and action of colours and light. No more interesting or important an aspect of the painter's craft is presented to us than the study and knowledge, to a far greater extent than the preceding few lines may cover, of the laws of colour.

For the present purposes of this paper, I will now briefly draw attention to the *classes* of colour into which our pigments are usually divided. It will be observed that, so far, I have confined my list of ordinary coloured pigments to those of the yellow, red, and blue kinds. These are usually termed the *primary* or source colours; since by judicious admixture and compounding of these pigments, and with the further assistance of white and black, any tint, hue. and shade of colour can be obtained, subject only to the purity and perfection of the primaries so compounded.

I will here haste to state, lest someone learned in "light and chemistry" amongst my readers may consider my selection of the primaries as based on an error in optical science long since exploded, that due attention to the latest and more proven theories of prismatic colour will be noticed in their proper time. My adoption here of Sir David Brewster's primaries is but a matter of literary and practical policy, the best means to present ends.

The primary pigments, then, being the first simple division, and consisting of blues, reds, and yellows, by combining chemically suitable blue and red we obtain purple; with red and yellow we get orange; whilst blue and yellow pigments combine to give us green colours or sensations. These resultant admixtures of any two primaries are termed *secondary* colours; and again by a similar process of mixing, in certain proportions, two of the secondary pigments together we obtain the third distinct class into which we divide our colours, which third division is known as the *tertiary* colours.

My purpose in thus generally confining myself to the primaries in the preceding list of house-painters' pigments will now doubtless explain and commend itself to the reader. With all those pigments at hand almost every variety of colour, requisite or desirable for our ordinary use, can be prepared; some portion of *brains* being, I need scarcely add, usually also required.

Since I have already indicated the results of adding any two of the primaries together, I will here advise the young painter to practically work this matter out himself by mixing some of those pigments together, the appearance and nature of which he is now somewhat acquainted with by the careful study of my simple list.

In compounding painters' pigments there is yet a further matter requiring some little consideration by the worker. Not all of our blue pigments are chemically suitable for mixture with yellows or reds, nor all yellows with reds—in fact, a knowledge of the chemical source and affinities of pigments is almost a necessity to the painter and decorator. As the most brief and simple way of aiding the student, I will now define those ordinary pigments which it is usually advisable *not* to mix together.

For mixing in oil colour paints, chrome is an undesirable pigment, and it is particularly to be avoided when compounding *greens* from *Prussian* or *Antwerp* blues, which latter colours it would eventually destroy. In such an instance, for common use, the best substitute for the chrome would be bright *yellow ochre*, or, as it is often labelled, yellow paint. *Raw Sienna* can also be used with the above blue pigments without much detriment to either. In any case where a bright *mixed* green is absolutely necessary, I may say that the lemon chrome can be used in conjunction with good *ultramarine* blue or *indigo*.

In compounding the secondary colour of *purple* from the blues and reds I have given, there is less danger of trouble arising. For oil painting the best and purest are obtained by mixing ultramarine with *madder lake* (which is a beautiful crimson and transparent pigment equally as permanent as lakes derived from cochineal are unstable), or ultramarine and vermilion will answer. Prussian blue and vermilion give very deep purple, which may be lightened up with white. For common purposes the cheap purple brown is most useful, if required full in strength; but if lighter and pure tints are wanted in oil or distemper, ultramarine blue and vermilion, or, for cheapness, Venetian red, is necessary. Prussian blue in water would *not* suit so well, but indigo could be used if cost was not a consideration.

The remaining secondary, *orange*, is not a colour very much called for. In *orange chrome* or *orange red* we have a bright opaque pigment, but otherwise, like all the chromes, not a commendable article. *Burnt Sienna*, previously mentioned in my list, is a very opposite pigment in both nature and source. It is semi-transparent, reliable, and permanent, and, what also the practical student must always bear in mind, it is, when of good quality, a remarkably strong stainer, like Prussian blue in this respect. In compounding orange colour the reds and ochres I have mentioned are usually bright enough; yellow ochre and Venetian red, or raw and burnt sienna together, give us, with white lead, a good and serviceable variety of permanent orange and salmon tints.

The compounding of the third division of material colours, the tertiary, from either of the two secondaries is a subject I need scarcely here dwell long upon. The student who works at this subject practically will soon find from the foregoing and subsequent remarks those secondary pigments of orange and green which produce the tertiary *citrine*, whether bright or sombre, such as occasion requires. Of the remaining tertiaries, *russet* and *olive*, prepared from the secondaries purple and orange, purple and green, respectively, we have a good supply in the form of simple pigments. Notwithstanding, therefore, the necessity and advantage of the worker being able to obtain any colour by the admixture of the three primaries, it is always most economical to use a simple article of the desired colour when such is to hand.

Having now brought before my readers the simple outlines of colour-mixing, I will here append a selection of the most serviceable and everyday pigments of the secondary and tertiary classes which are to be obtained ready for house-painters' use from the manufacturers.

I need scarcely point out how unnecessary, and almost impossible, it would be for me to include here all, or even one half, of the various greens, browns, etc., which are now upon the market. I take up the wholesale colour list of a Newcastle-on-Tyne manufacturing house and find therein a dozen or more kinds to every primary, secondary and tertiary. The bulk of these merely represent differences in nature, hue, or brightness, and three-fourths of which compositions, each rejoicing in some fanciful, and often incongruous, name, could be as easily prepared by the worker himself who understands that little of the nature and qualities of pigments I have herein endeavoured, I trust not without some success, to make plain and intelligible from every point of view.

Green pigments, chiefly derived from the mineral sources of copper, are very plentiful and reasonable in price. Emerald green is the brightest, and is useful to the house painter both in oil and distemper, in which it aids us to get very clean and bright tints. I well remember when it was used in house painting to a great extent, and when some of the aristocratic residents of Westminster and Belgravia were quite satisfied with emerald green tints on their dining-room or morning-room walls. Nowadays, however, what with Sanitary Congresses and Health Exhibitions, the merest suggestion of green is usually interpreted "arsenic," and since the deleterious nature of such copper greens is certainly a definite source of trouble, everybody can be satisfied with seeing less of them.

Brunswick greens, quaker greens, chrome greens, etc., are all useful pigments, owing their colour to, I believe, their preparation from the same mineral sources as Prussian blue and chromes. Generally it may be granted that they are reliable and fairly permanent for their cost, about 3d. to 6d. per lb. retail; but remembering my remarks about the mixtures of the chromes and blue, the painter will do well to avoid their use for tints with white lead in good and permanent interior work. Bronze, olive, and invisible greens are, as their names imply, deep but richly-toned pigments, very useful for external painting and very reasonable in price. They can be almost as easily mixed by compounding black and yellow pigments, or black, blue, and green, according to the particular hue or "cast" that may be desired.

Since we have a surfeit of greens and yellows it follows that there is little need for citrine pigments: they can be mixed best and easiest from those secondaries. Coming under this heading, however, are usually classed the *umbers*. The most common is usually termed raw umber, a natural ochre found almost all over the world. The best is Turkey umber, and this, after burning, which makes it richer and warmer, when it is known as burnt umber, is one of the most useful pigments. For graining it is almost indispensable, and for all general purposes of painters' and paper-stainers' work it is one of the most valuable aids to soft and modest colouring, both in oil and water processes, we possess. Its price varies, according to quality and preparation, from ½d. to 1s. per pound. Of the umbers and Vandyke brown I shall have, necessarily, more to say in the papers in which I shall deal with graining and other imitations, so I may spare the reader any further remarks on them here.

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HOW TO PAINT A STAINED GLASS WINDOW BLIND.

BY FRED MILLER.

Painted glass for domestic purposes requires a totally different style of work and design to that intended for ecclesiastical windows. It should be simpler in design and less severe in treatment, and the effect largely obtained by "tracing" rather than by elaborate leading. Church windows (I speak of figure windows) owe their effect to the use of coloured glass, and the disposition of the leads that bind each separate piece of glass into a complete design. In the window blind we propose doing as our first effort at glass painting, the glass is simply cut into squares, say 3 in. and 3½ in. or even 4 in. square, and each square is painted or "traced," as it is technically termed, in a solid brown colour, known as tracing brown. The glass is then "stained" at the back with "yellow stain," fired, and the glazier then leads the squares together and completes the blind.

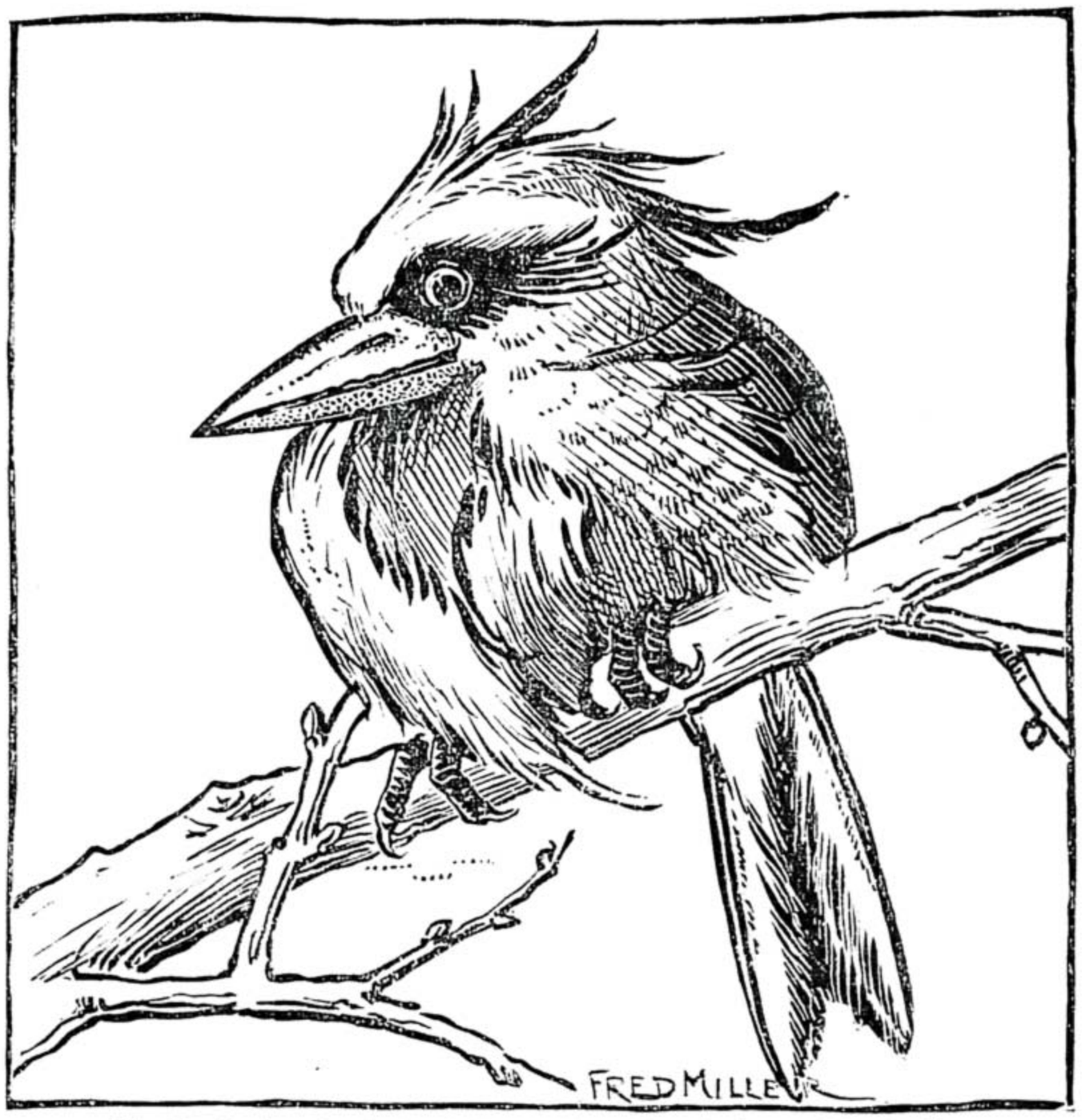

Fig. 1.—Design for Stained Glass: Laughing Jackass of Australia.

This tracing brown and other glass colours can usually be obtained where you get your glass cut, viz., of a firm who produce leaded glass for the trade, such as Pepper & Boyes, in the Euston Road, for I must here assume that my readers do not attempt to do the cutting and leading for themselves, these both being distinct branches of the work from the painting of the glass, and in the trade are confined to a separate class of craftsmen. You must measure the size of your window, and if you are going to put the glass into a wooden frame, as is usually the case, you must make due allowance for the space occupied by the frame. Get out a piece of paper the size the glass is to be, and bisect its length and width. Assuming that the squares are 3½ in., just see how many you can get in the length, for it does not look well to have to cut down one row of squares; you want to get in a complete number. This can always be effected by slightly altering the size of the square, and sometimes, in order to get a complete number in in the width, it is necessary to reduce or increase the width of each square, as the case may be, in order to work them in.

It is a nice finish to a window blind to have one or two "lines" of glass round the outside, as in Fig. 4, the outside one varied whites, and the inside one ruby. If you tell the glazier to whom you go to get your glass that you want a white and ruby line outside, he will at once know what you mean.

There are many makes of glass, but one I often use myself because of its charming effect is "Anbetti." It has a slightly rough bubble surface (some of it is more "bubbly" than others, and this kind is useful if it is desirable to block out an ugly look-out or prevent people seeing in).

When you get your glass, clean each square very thoroughly with a damp leather, and polish with a dry cloth. Any suspicion of greasiness will prevent the colour taking to it. The tracing brown must be thoroughly ground up, and the most effectual way to do this is to use a glass muller on a piece of ground glass. To every six parts colour put about one part loaf sugar and mix well with the colour. The sugar binds the colour to the glass and enables you to work it easily.

You can tell if you have enough sugar in your colour by putting a little on a piece of glass and drying it. If it dries dead looking and will not rub off by passing a dry finger over it, you know it is then right in consistency. If it rubs off easily put more sugar; if on the other hand it dries shiny and sticky, there is too much sugar, and you must add more dry colour.

Colour improves by being kept, as it then works more smoothly; but keep it out of the dust. When it is hard on the palette you have only to moisten it with water and mull it up again.

Tracing brushes are long black sable writers that come to a fine point, and at the same time hold plenty of colour in their hair. At some brush shops they keep what are known as glass tracing brushes.

Place one of your squares over your design (say one of the designs given in this number of Work), and filling your brush with liquid colour try and follow the lines of the design accurately, and yet with freedom. Be true to the spirit rather than to the letter of the design, for tracing that looks mechanical is never good. Tracing must be done with feeling, but this only comes of practice, for at first you will feel awkward, and will not be able to get the colour to flow freely from the brush on to the glass.

You want to get a certain body of colour on, for the tracing should be fairly solid so as to be opaque when held up to the light. Remember that glass tracing has to look well when held up to the light. Never work with a dry brush. Always keep the colour fluid, and continually charge your brush with fresh colour, so that it flows freely on to the glass.

Some of the markings on the bird and frog would look better to be less opaque. Such markings are done with colour thinned down with water and put on thinly. An experienced glass painter can produce a charming variety by the use of thinner colour in some portions of the work, for although the tracing must on the whole be opaque, yet it should not

Fig. 2.—Design for Stained Glass: Toad with Toad-stools.

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be mechanically so. A semi-transparent line here and there gives variety and takes away the hard look that work has which is equally solid everywhere. This is the light and shade of tracing, and though you will not possibly be able to attend to such points as these at the outset, it is well to have an ideal before you to keep you up to the mark.

The beautiful transparent yellow so constantly seen in glass windows is produced by chloride of silver. It is known as "yellow stain," and you could doubtless purchase a little of the people who cut your glass. It is mixed with turpentine, with Venice turpentine added to bind it on the glass, as we used sugar with the tracing colour, and is always put on the back of the glass, for this stain enters chemically into the glass, under the action of heat, and has a tendency to destroy other colours that are touched by it. Put the yellow stain on with camel-hair brushes, keeping well within the traced lines so that when held up to the light only the particular part of the design destined to be yellow is stained. In the case of the bird and frog "quarries" (as the squares are called), don't stain anything but the bird and frog—*none* of the accessories, such as grass or tree. The squares are now complete, and must be sent to the kiln to be burnt. The heat melts the tracing colour on to the glass, making it permanent, while the silver is driven into the glass and stains it yellow. By the way, I must not omit to say that a thin wash of the silver stain produces a pale yellow, while a heavier wash gives an orange.

Fig. 3.—Design for Stained Glass: Chrysanthemum conventionally treated.

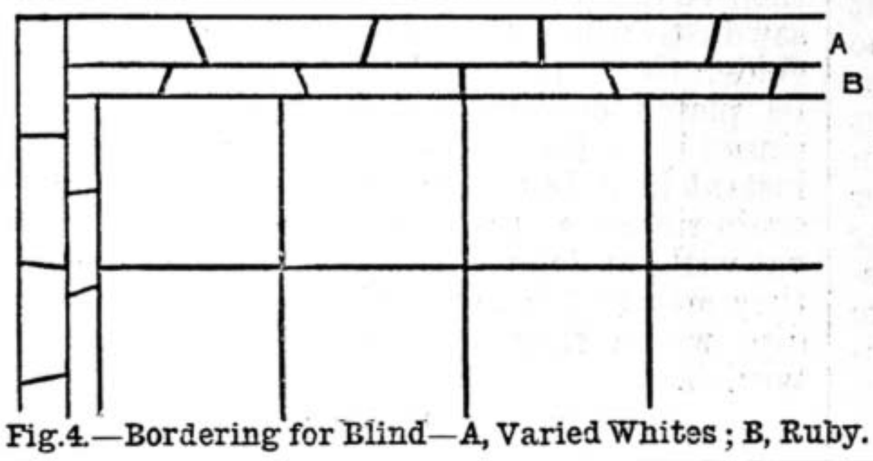

Fig. 4.—Bordering for Blind—A, Varied Whites; B, Ruby.

Designing.

The treatment of squares with quaint renderings of birds, animals, fish, etc., alternated with ornamental or foliage quarries, is one that gives an entirely satisfactory result. I myself constantly adopt this treatment in my own work, and for large staircase and hall windows the effect is rich without lessening to any great exent the amount of light admitted through the squares. It warms and softens the light and imparts a glow to the walls and furniture, and in cases where it is desirable to shut out the gaze of the curious, painted leaded glass should always be used in preference to the cold, formal, mechanical embossed and ground glass. The variety of tint obtained with the yellow stain is infinitely varied, and has a most beautiful appearance when a large number of squares are leaded together. The squares themselves should be cut out of various tints of white, and the stain takes differently on a greenish-white to what it does on a yellow or grey white, and so on.

In drawing birds and animals for quarries try and accentuate any characteristic of the creature you take a suggestion from. Ornamentalise, as it were, the details of your subject, and get the effect with as few lines as possible. You cannot keep this work too simple in execution. Attempt nothing in the way of light and shade, only so far as it is needful to obtain clearness of form and relief. When you come to stain the quarries you can keep the stain thin in the lights, and darker on the side that would be in shadow. This kind of light and shade produced by varying the stain gives a most excellent result. The more you vary the squares the better, and in window blinds no two ought to be alike. The Japanese books of designs will suggest a good many *motifs* to those who cannot invent for themselves. I have myself drawn a great deal in the Zoological Gardens, and the two designs given here in Figs. 1 and 2 are simply quaint renderings of two Zoo sketches. Fig. 1 represents the Australian bird known as the Laughing Jackass, and Fig. 2 the common Toad with two of the fungus known as toad-stools to form a suitable background. The other two designs in Figs. 3 and 5 represent respectively the blossom of the chrysanthemum and the fruit of the pomegranate conventionally treated.

Alternate the bird quarries with ornamental ones, and do not vary the pattern, as these squares are to be a foil to the animal ones. One window blind might have one pattern, and the other blind the second design. Stain these ornamental quarries very lightly, except the seeds in the pomegranate, and the cusp of the flower. Remember not to carry your tracing up to the edge of the squares, so that a portion is cut off by the lead, but leave a good $\frac{3}{8}$ in. all round.

If the entire work has been carefully carried out in the manner indicated above, it may be taken as being a matter of absolute certainty that the glass painter himself will be pleased with it, and his friends also. The liking for the work will grow upon him, and in all probability he will in time proceed from window blinds to windows for staircases and glazed doors, which look very well when treated in this way.

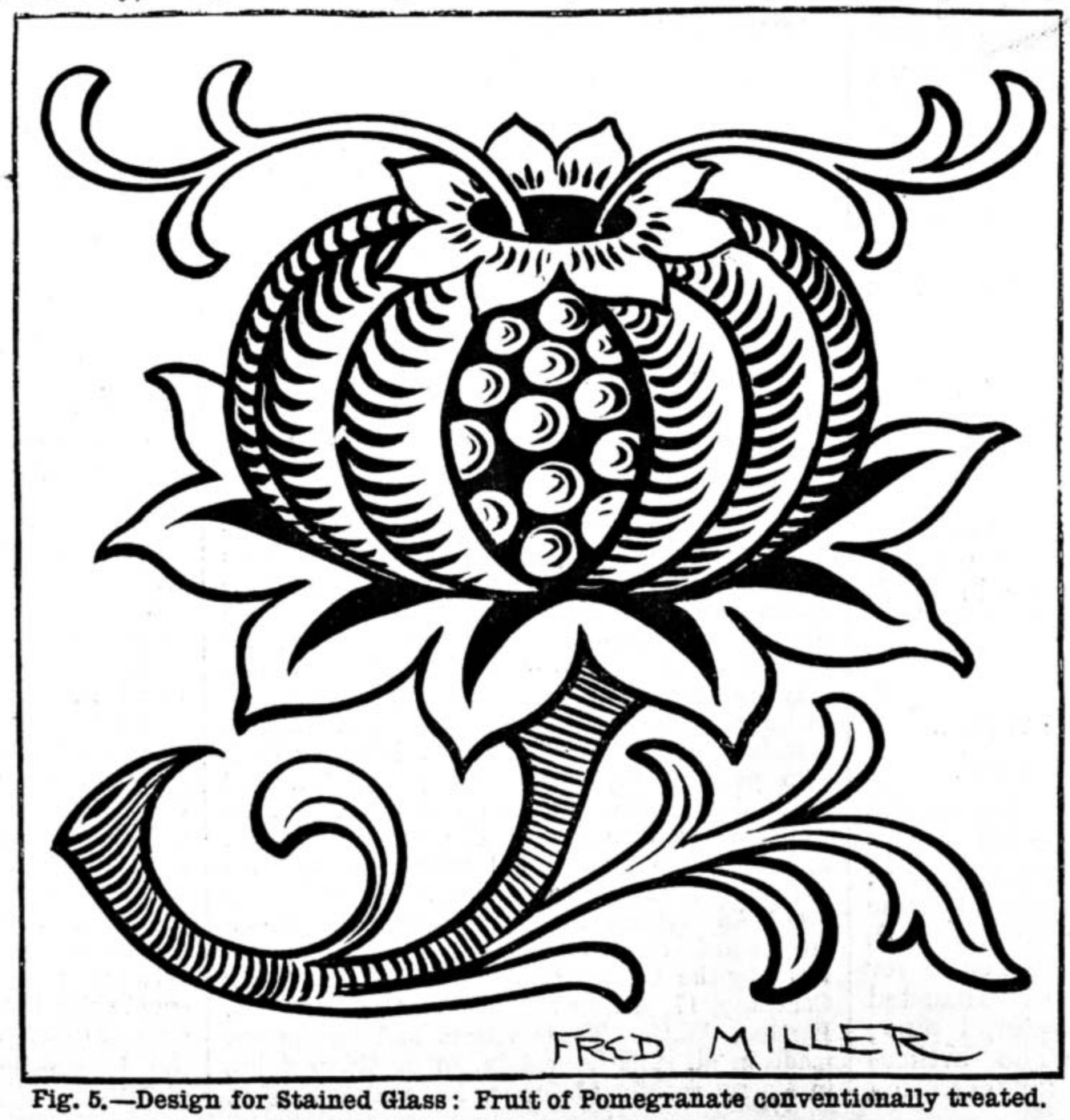

Fig. 5.—Design for Stained Glass: Fruit of Pomegranate conventionally treated.

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SOME NOTES ON BRASS.

BY GEORGE EDWINSON BONNEY.

Brass.—Brass is an alloy, composed of copper and zinc in various proportions, as will be seen from the following list. In some varieties of brass a little tin is added. Soft brass, for turning into ornamental articles, contains a small quantity of lead.

TABLE OF VARIETIES OF BRASS.

Name.	*Copper.*	*Zinc.*	*Tin.*
Sheet Brass	84·70 parts	15·30 parts	0
Wire ,, ...	70·29 ,,	29·26 ,,	0.17
Gilding Metal ...	73·73 ,,	27·27 ,,	0
Mosaic Brass... ...	66·00 ,,	33·00 ,,	0
Dutch Metal	84·70 ,,	15·30 ,,	0
Prince's Metal ...	75·00 ,,	25·00 ,,	0
,, ,, ...	50·00 ,,	50·00 ,,	0
Muntz Metal ...	60·00 ,,	40·00 ,,	0
Bell Metal	80·00 ,,	20·00 ,,	0
Pinchbeck	80·00 ,,	20·00 ,,	0
Watchmaker's Brass	33·50 ,,	66·50 ,,	0
German Brass ...	33·50 ,,	66·50 ,,	0
Yellow Brass ...	66·50 ,,	33·50 ,,	0

Published formulæ respecting the composition of brass alloys are apt to differ in the proportions of the metals to be employed. Mr. Bloxam gives the proportions of Pinchbeck as 3 parts of copper to 1 part of zinc. Bell metal is given in the above list as composed of copper and zinc, whereas Mr. Bloxam says it is an alloy of copper and tin. It is, therefore, a bronze, not a brass. The colour of brass is dependent upon the proportions of the two metals used in its composition. When there are more than 80 parts of copper in the hundred parts of alloy, a red tint predominates, which is increased as the quantity of copper increases. On the other hand, the colour becomes yellow when less than 80 per cent. of copper is present in the alloy, and the yellow tint gets lighter until 30 per cent. of copper is reached, after which the alloy cannot any longer be regarded as being of a yellow tint, but more nearly approaches that of zinc. The fusibility of the alloy increases as the quantity of copper decreases. This known property is taken advantage of in selecting a suitable solder for hard soldering articles made of brass, the yellow varieties being available as solders for the reddish varieties. Hard solder for brass may be composed of 79 parts of good tough brass added to 21 parts of zinc, using borax as a flux. Further information will be found in article on "Soldering Brass." Brass articles, tarnished or corroded, must have the tarnish or corrosion removed before they can be coated with metal by electro-deposition. It is not enough to scour off the corrosion by mechanical means, since this would still leave minute specks of dirt on and in the surface of the metal, and prevent perfect adherence of the coat of electro-deposited metal. Corrosion and tarnish are, therefore, removed in an acid pickle, made up of a mixture of acids for the purpose in hand. These are sometimes named "acid dips," and also "dipping acids." A good pickle for brass is composed of—

Sulphuric Acid	3½ pints.
Nitric Acid	1½ ,,
Common Water	1 pint.

Mr. Sprague gives the following as the composition of a pickle used for brass, copper, and German silver :—"Water, 100 parts; oil of vitriol, 100 parts; nitric acid, specific gravity 1·3, 50 parts; hydrochloric acid, 2 parts." Mr. Urquhart recommends for "bright dipping" a mixture of exhausted nitric acid, half a pound; water, 1 pint; hydrochloric acid, 3 lbs. The articles must first be cleared of all corrosion by dipping them in strong nitric acid; they are then allowed to soak in the "bright dip" for some minutes, and then well rinsed in clean water to clear off the black slime remaining on them. Mr. Watt gives the following as the composition of a dipping acid to produce a bright and clear surface on "certain classes of work":—

Nitric Acid, Commercial (by measure) ...	1 part.
Sulphuric Acid ,, ,, ...	2 parts.
Water	2 ,,

A pickle for "dead dipping" (that is, to give a dead or matted appearance to brass), as recommended by the same author, is composed of "brown or fuming aquafortis, by measure, 2 parts; oil of vitriol, 1 part. To the above mixture a small quantity of common salt is added." This mixture works well on both copper and brass, but it must be used in the open air, where a strong draught can blow the poisonous fumes away from the workman, or else be worked in a "stink cupboard," provided with a flue and a good strong draught of heated air. The fumes are always worse in damp air, as on a damp day or on the near approach of rain. A similar precaution must be observed in the use of the American brass pickle, which is composed of sulphuric acid 2 parts, and nitric acid 1 part only. This is an excellent pickle for brass castings or corroded brass of all kinds, but the articles must be moved quickly in it, and well rinsed in an abundance of clean water the instant they are removed from the pickle. They should then be dried by rubbing or tossing in hot sawdust, when they will assume a nice golden tint. If the pickled articles are to be plated or gilded, they should be well rinsed in at least two waters, dipped for an instant in a bi-tartrate of potash solution, again rinsed, and passed on to the plating-vat without delay. If not wanted at once, they may be left in the bi-tartrate of potash dip, where they will be protected from tarnish.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

105.—BEIT'S ENAMELLED ADHESIVE WATERPROOF ADVERTISING PAPER LETTERS AND FIGURES.

AMONG the most useful articles that are supplied as a means by which any dealer may call attention, if he so desire it, to the specialities which he manufactures on the one hand, or sells on the other, there are none perhaps that are more useful than paper letters and figures, for by aid of these show-cards and ticket boards may be speedily prepared in a most effective manner by those who are not possessed of sufficient skill to paint these things for their own purpose, or, to use the proper technical expression, "write" them on card-board or on wood, or even on glass. The best letters and figures of the kind that I have seen for this purpose are "Beit's Enamelled Adhesive Waterproof Advertising Letters and Figures," which are manufactured and supplied wholesale and retail by the Oxford Show-Card Manufacturing Company, 17, Arthur Street, New Oxford Street, London, W.C. These letters and figures are made in all sizes from ⅜ in. in depth to 6 in., in a great variety of forms, and in gold, silver, and all colours. Rules, corner-pieces, or ornamentations of different kinds, hands, left and right, halfpenny signs, and the sign £, used to denote pounds sterling, may also be had at prices ranging from 1s. per gross upwards according to size, but I may say that sizes, shapes, and prices of letters will be ascertained from the sample price lists which the Company will send to any applicant.

It may interest some readers to know that these letters are cut by aid of steel plates from 2 lbs. to 20 lbs. in weight, according to the size of the alphabet. The paper from which the letters are cut is enamelled and waterproof, so that the letters and figures can be washed, or, if put outside of any window, the rain and weather will not injure them. They are cut by machines to insure uniformity, and the paper can only be purchased in Germany, as nothing resembling it is made at present by English manufacturers. The sheets, in fact, are so large that eight sheets imperial can be cut out of one of them. The letters, when cut, are sorted and bundled up in tens, and many millions are constantly kept in stock ready for use. Being gummed at the back, they have only to be wetted and stuck on any surface, whether of card-board, wood, glass, earthenware, or even iron. The gum used, I am told, is not an ordinary gum, but is a composition which will hold fast to anything, and which, at present, remains a "trade secret." For show-cards and price tickets for shops the letters and figures stand out clear and distinct, and they have the merit of being very durable. They may be used for banners in bazaars, etc., for letter-boxes, for numbering houses, for names on plate-glass windows, sign-boards, bookshelves, and many other purposes. The Company has agents in all parts of the world and the United Kingdom. I mention this because many a general dealer and seller of fancy goods might find it useful to add them to their stock.

106.—WILLCOX BROTHERS' PAPER LETTERS.

As I am writing on paper letters, I may take the opportunity to mention that another very effective kind of paper letters, useful for all indoor purposes and positions where they would not be exposed to the weather, are cut and supplied by Messrs. Willcox Brothers, Paper Letter Cutters, 172, Blackfriars Road, London, S.E. These letters are hand-made, being cut with scissors or knife from plain or coloured paper, six or eight at a time. I have specimens of these letters before me in all colours from 1½ in. to 7 in. in depth, but they are cut in larger sizes than these, even up to 24 in. in depth. Up to 4 in. the price per dozen is 4d. plain and 6d. coloured, but above these the prices range from 5d. per dozen plain and 6d. coloured for letters 5 in. deep to 4s. plain and 6s. coloured for letters 24 in. deep. Fancy cut letters are 1s. 6d. per dozen, and gold and silver letters double the price of shaded letters. Letters shaded in three colours are double the price of shaded letters. Further information as to prices, etc., can be obtained from the makers. The shaded letters are first cut in one colour, and then pasted on to paper of another colour and cut again. Nothing is claimed for them beyond cheapness and effectiveness. Being on thin, common paper they can be utilised anywhere, and can be used on almost any material, and being cheap they can be changed at pleasure when the season may demand it. They may be turned to excellent account for announcements of any kind, and when cut in Church text or Gothic form will be found useful, effective, and cheap as lettering for church decorations. They may be further utilised for announcements of any kind, and especially for concerts and entertainments and meetings of any kind, whether in town or country. The chief points to which to pay attention are the placing of the letters between truly horizontal parallel lines, and equalising the spacing between the letters. Care of this kind bestowed on the work cannot fail to add to its beauty and efficiency when completed.

THE EDITOR.

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SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** NOTICE TO CORRESPONDENTS.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Portable Sketching Tent.—W. A. M. (*Warrington*) writes:—"The enclosed is a rough sketch of a portable sketching tent. Can you tell me if there is one in use at the present time? The idea, as I have tried to show in the sketch, is to combine

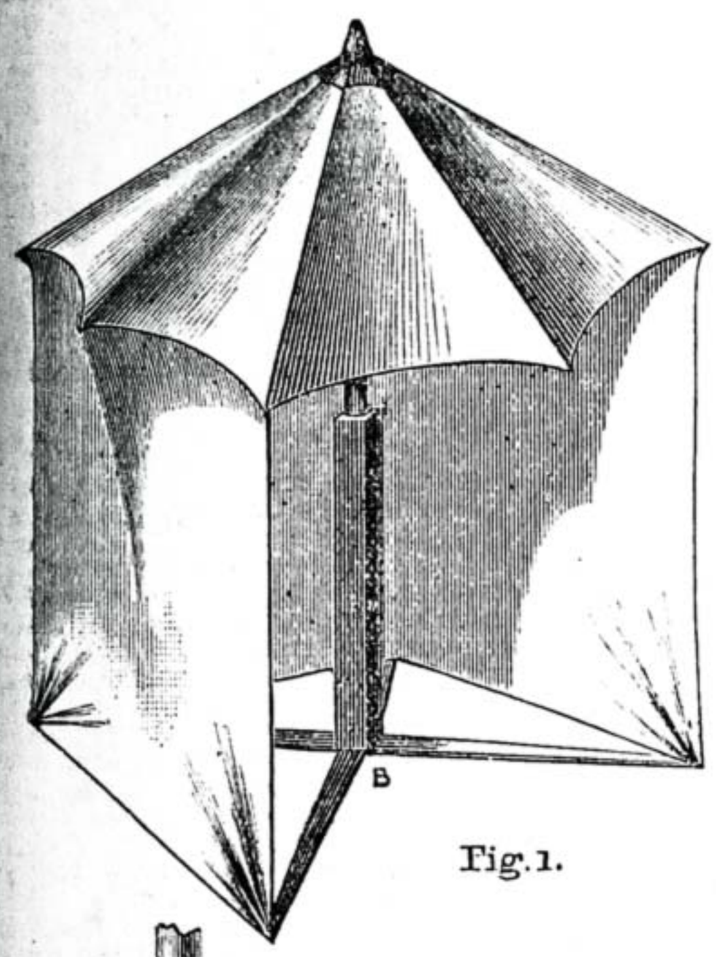


Fig. 1.

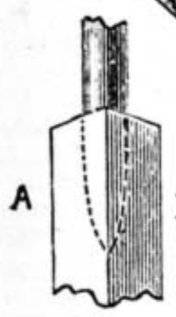


Fig. 2.

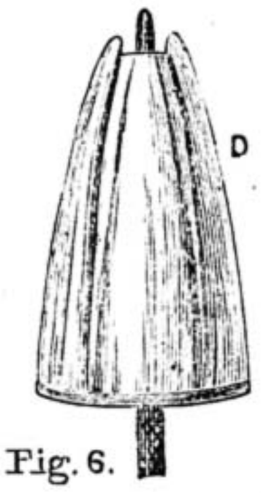


Fig. 6.

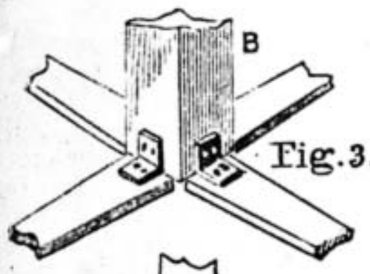


Fig. 3.

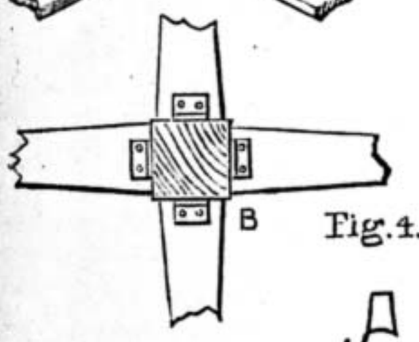


Fig. 4.

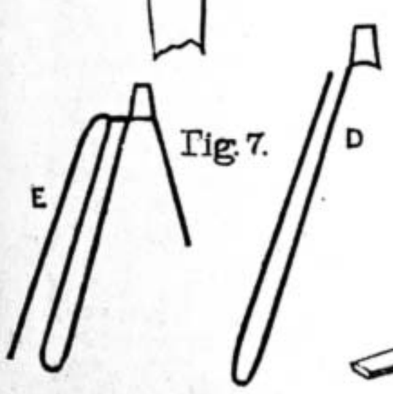


Fig. 7.

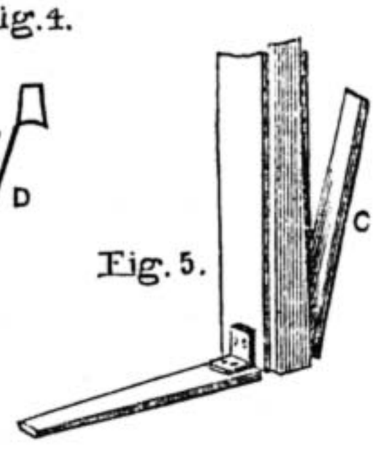
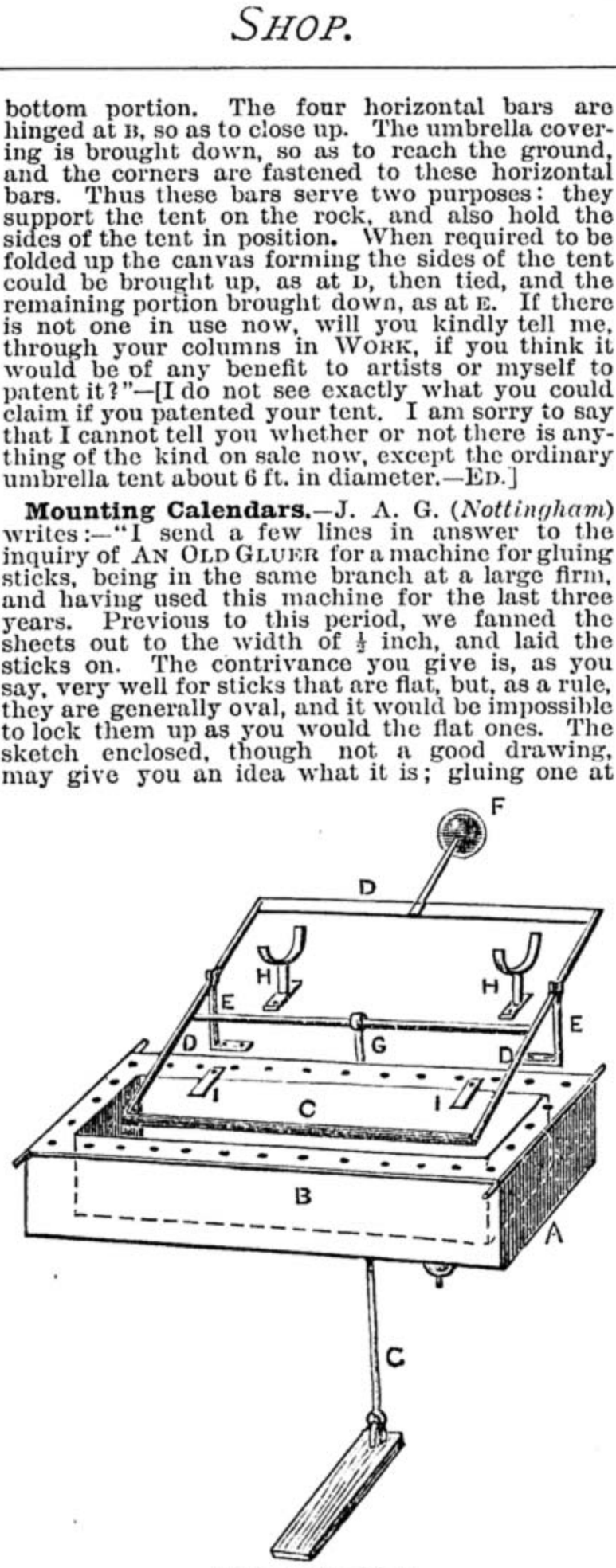


Fig. 5.

Fig. 1.—Portable Sketching Tent, complete and fixed. Fig. 2.—Top of Socket to receive Umbrella Handle. Fig. 3.—Foot of Upright to receive Umbrella Handle. Fig. 4.—Plan of Fig. 3. Fig. 5.—Bars turned up round Socket. Fig. 6.—Canvas folded up round Umbrella. Fig. 7.—Canvas brought up Umbrella (D) and down (E).

simplicity in working and lightness for carrying purposes, and also the tent to be adapted to be pitched on rock as well as on the soft soil. At A, in the sketch, the umbrella handle fits into the bottom portion. The four horizontal bars are hinged at B, so as to close up. The umbrella covering is brought down, so as to reach the ground, and the corners are fastened to these horizontal bars. Thus these bars serve two purposes: they support the tent on the rock, and also hold the sides of the tent in position. When required to be folded up the canvas forming the sides of the tent could be brought up, as at D, then tied, and the remaining portion brought down, as at E. If there is not one in use now, will you kindly tell me, through your columns in WORK, if you think it would be of any benefit to artists or myself to patent it?"—[I do not see exactly what you could claim if you patented your tent. I am sorry to say that I cannot tell you whether or not there is anything of the kind on sale now, except the ordinary umbrella tent about 6 ft. in diameter.—ED.]

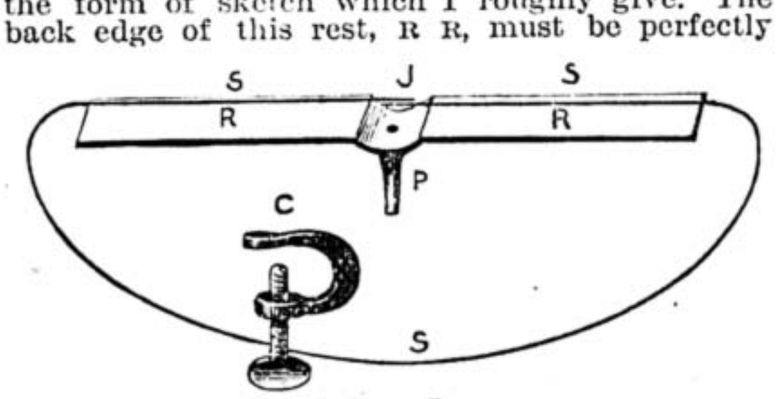
Mounting Calendars.—J. A. G. (*Nottingham*) writes:—"I send a few lines in answer to the inquiry of AN OLD GLUER for a machine for gluing sticks, being in the same branch at a large firm, and having used this machine for the last three years. Previous to this period, we fanned the sheets out to the width of ½ inch, and laid the sticks on. The contrivance you give is, as you say, very well for sticks that are flat, but, as a rule, they are generally oval, and it would be impossible to lock them up as you would the flat ones. The sketch enclosed, though not a good drawing, may give you an idea what it is; gluing one at



Gluing Machine.

once, you can glue as many as 600 per hour in the machine. The outer pan is iron; the inner or glue pan is copper. The outer pan, of course, is for steam entering at the back with an outlet at the bottom. May be you will see the difference of the parts by letters: A, the outer pan; B, the inner pan; C, the gluing bar; D, frame for carrying bar; E E, loops screwed to bench to carry the frame; F, balance weight; G, treadle; H H stands screwed to bench to hold the sticks; I I, pair of tips to hold the stick while the glue bar or rest comes up from the pan. The bar is only ¼ in. thick and 2 in. wide, and the length of pan."

Brazing Band Saws.—A. R. (*Scorrier*) writes:—"Although this is a simple job, there are many that cannot succeed in effecting a good joint. The following is the most simple way that I know of, and I may say I have made hundreds of brazes in band saws. In the first place take a piece of ¼-in. or ⅜-in. iron 4 ft. long, 1½ or 2 in. wide; make it in the form of sketch which I roughly give. The back edge of this rest, R R, must be perfectly



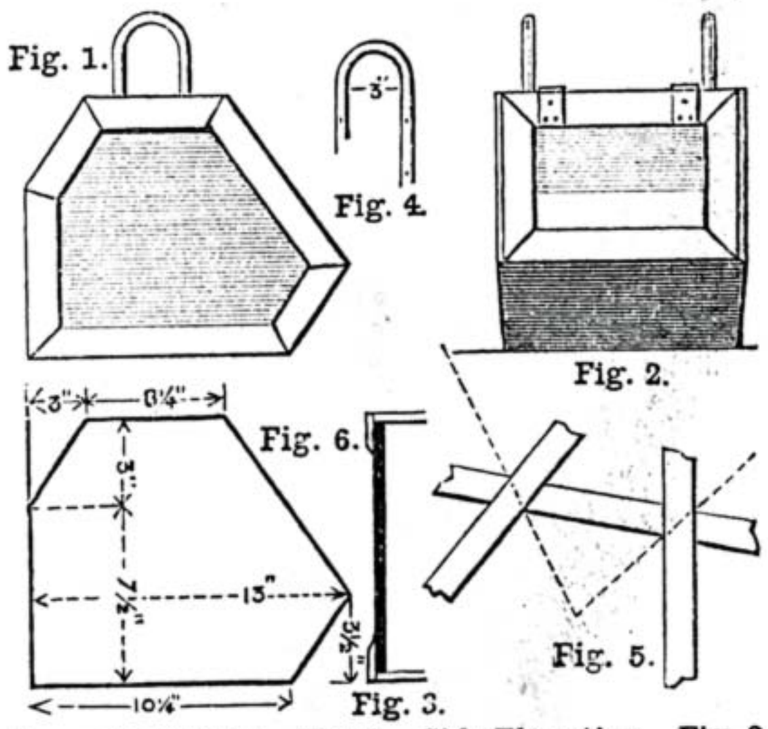
Band Saw Braze.

straight, to which two narrow strips of iron, S S, should be fastened. A piece of iron, P, should be welded, or a hole tapped, and the piece, P, screwed to the centre of the rest so as to hold it in a vice, or insert it into a hole in a small iron horse while the saw is being brazed. Now scarf the ends of saw with a file the length of 2½ teeth. To do this the ends of saw need not to be warmed if the saw is of proper temper. Now place the saw on the rest, keeping the back of saw close against the strips, S S; this will keep the joint straight. Now take four cramps, made as C with thumb screws, and screw on rest, R R, to keep saw in position. Then damp the ends of saw, and take a little powdered borax and mix with a little coarse brass spelter, and place it between the ends of saw, or where they lap at J. All now being ready for brazing, take a pair of heavy tongs and heat them in a fire till bright hot; another lighter tongs must be made black hot. Take the heavy tongs and close it tightly on joint J. As soon as the spelter has properly run this tongs should be slipped off, and the black hot tongs, which has been held in readiness by a boy, slipped on and closed tight for a few moments. Take it away, unscrew the cramps, and lightly hammer the joint on the horse or vice. Then file it a little, and to improve the look of the braze rub it with a piece of emery cloth, and the job is completed. With a little practice a dozen or more brazes may be made in an hour. I may add that no binding wire is required."—[I am obliged for your name and full address, and for your further communications to "Shop."—ED.]

Combined Bedroom Suite.—J. H. H. (*Oldham*) writes:—"I thank you very much for J. S.'s answer, containing all the information I desired. I enclose a rough tracing from the combination bedroom suite, with the alterations I intend trying to make in it."

Combined Bedroom Suite.

Simple Cheap Coal Vase.—G. W. (*Bournemouth*) writes:—"I send you particulars of a simple cheap coal vase well within the power of an amateur to make, something useful and ornamental. Sizes given are suitable for artisan or small dwelling, and



Cheap Coal Vase. Fig. 1.—Side Elevation. Fig. 2.—Front View. Fig. 3.—Section showing Rebate formed by Moulding. Fig. 4.—Handles, $\frac{7}{16}$ Round Iron. Fig. 5.—Mode of Marking Mitre. Fig. 6.—Size to cut out sides; all measures from back and bottom line as shown, ⅜ or ½ thick.

may be curtailed or enlarged to taste or requirements; made in pine or mahogany, birch or mahogany mouldings likewise to taste. Those made by myself were pine with birch mouldings, plain

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iron handles, covered by a saddler with brown leather, for a few pence—may be brass or silver plated—brass hinges, birch moulding 2 in. wide, ¾ thick, chamfered ¼, glued on to pine sides (mitred of course), and a few panel pins driven in from back, or bootmaker's rivets ¾ in. long—nearly same thing. Having prepared sides, mark or gauge a line on back of moulding ⅝ in. from edge. Stick a couple of pins in line for quick guidance. To get the mitre, place two pieces in position, mark from angle to angle, cut and glue on (Fig. 5). When sides are finished, cut any stout piece for bottom 10½ in. long. Nail or screw in rebate formed by moulding (Fig. 3). Lid made same way. With ordinary care a snug, clean job will result. Give a coat of size, *i.e.*, good size thinned with turps. When quite dry clean up (if required) with No. 0 paper and clean turps, and thoroughly varnish or polish if equal to it. Handles are put through the top, and fixed inside with short screws. If of advantage to any one wishing to procure materials, I could supply some sawn in the rough, handles and hinges, pine and birch, 4s. 3d. net."—G. W.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Bookbinding.—G. F. S. (*Nottingham*).—I hardly know how to answer your query. You ask for an article or two on Bookbinding. As the space devoted to "Shop" talking is limited, it would be impossible to give lengthy articles. But articles upon bookbinding have been written, and will appear, no doubt, as soon as convenient in the body of the paper. There is no good and cheap book on this subject that I could recommend. Any that I have seen are very much taken up with the history of bookbinding, and describing the bindings of the old masters, who lived centuries ago. This is all very good in its place, but it gives no wrinkle to the amateur to enable him to bind his books. I am quite at one with you regarding the interest likely to be taken in this subject when it appears in our Magazine. You had best make a start to bind your books, and when you come to a difficulty put it down in black and white, and send to "Shop," and I will put you right. Many thanks for your appreciation of WORK.—G. C.

Dynamo.—SEPTIMUS.—An illustrated series of articles on "How to make a Dynamo" will be forthcoming when space can be found for them in WORK.—G. E. B.

Dr. Tibbit's Medical Battery.—J. McG. (*Bootle*).—I am tolerably well acquainted with a dozen or two different forms of batteries, but do not know this. If you will give me some idea of its construction, I will tell you how to recharge it. Perhaps some other reader of WORK can oblige you.—G. E. B.

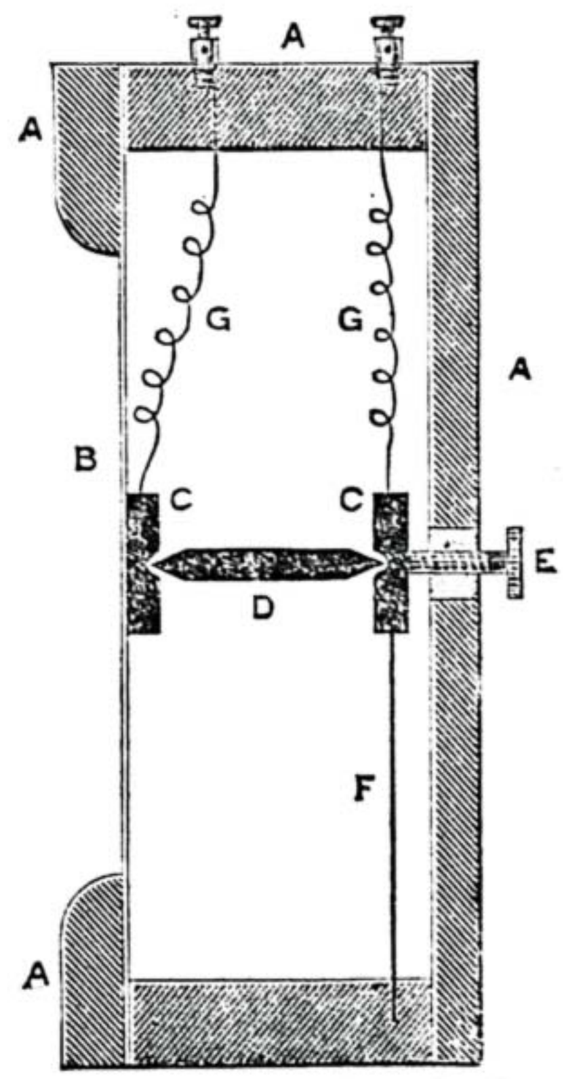
Telegraph Instruments.—H. G. C. (*Liverpool*).—My hands are full of work at present, so I cannot say when the promised articles on telegraph instruments will appear. As you have had several years' practical experience with telegraph instruments, perhaps you can oblige with a descriptive illustrated article on their construction. H. G. C. writes to inform H. D. and others that an excellent book on "The Philosophy and Practice of Morse Telegraphy" may be obtained from Messrs. E. S. Greeley & Co., Day Street, New York, U.S.A.—G. E. B.

Bicycle Materials.—F. W. R. (*Harling*).—1. There are no pliers, properly speaking, for turning spokes. There is a small wrench (Bauer's patent) that turns round objects as well as square: cyclists' size, 1s. 6d., of most tool dealers and cycle shops. 2. Tricycle fittings can be had of many firms. Try Wilkins & Co., 66, Holborn Viaduct, London, E.C.; Brown Bros., 7, Great Eastern Street, London, E.C.; Wm. Bonn, 308, Sunnie Lane, Birmingham, W. A. Lloyd, Waeman Street, Birmingham. Any of the above will supply all requisites. 3. Lines may be drawn of cycle frames and wheels with a large-size drawing pen, provided the colours are not too thick. For straight lines use a straight-edge, or tie a guide to the side of the pen. 4. Boiled linseed oil is used for work exposed to the weather in preference to raw. Raw oil is used for most interior painting and decoration. It is much lighter in colour and thinner than boiled, and therefore does not discolour fine pigments in the same way. 5. In turning slender rods in the lathe the practical turner keeps it running true to the tool with his left hand only. It takes considerable practice to do it, and an amateur could not be expected to do it for a considerable time. For iron work, when the work is of one thickness throughout, there is a guide fixed to the slide rest that travels with it immediately behind the cutter. In wood work for rods all of one thickness, such as broom handles, a hole is bored through a block of hard wood, and a cutter fixed in the hole in such a way that it will take off a shaving. The wood to be turned is first made eight-sided by planes or saw, then a little bit at the end is turned down to the size wanted. The block is now put on to this turned part, the work being now revolved in the lathe. The block is pushed along with both hands, and the rod is thus reduced to the size allowed by the cutter.—A. S.

Flow of Air in Tunnel.—COLLIER (*Bolton*).—You do not give us the section of the tunnel, so we must assume you refer to a rectangular heading, of which the sectional area would be 6 ft. × 9 ft. = 54 square feet. The cubic feet of air passing per minute will be (assuming it to be equally mixed with smoke in your observation) 90 ft. × 60 seconds × 54 square feet ÷ 23 seconds = 12,678 cubic feet per minute. Your measuring the velocity by the rate of travel of smoke indicates that a charge has been exploded, and therefore the regular current of ventilation disturbed, or otherwise that local smoke has been made that will not quite penetrate the whole current of air, in either of which cases the calculations will not apply. Send full particulars of the method of measuring the velocity, and the section of tunnel (if not rectangular), and you shall have reliable rules to work by.—F. C.

Boat Building.—PADDLER.—I should use thin mahogany with a long straight grain, and bend it on to the ribs of the boat, using steam at the bends if required. The slips of mahogany should be about 3 in. to 4 in. wide, or you could use pitch pine. Both look very well. The rivets, etc., can be obtained at any large ironmonger's.—A. J. H.

Microphone Transmitter for Telephone.—W. S. (*Leicester*).—It is somewhat difficult to write and advise upon telephone matters, because of the fact that both receivers and transmitters are so completely covered by patents. But as I see that your receivers are of the "English Mechanic" pattern, and as there is no fear of them coming under the ban of the patentees, I will give you the design of a microphone transmitter, which answers pretty well as a speech transmitter, and is not patented. It was devised by myself, and if it suits your requirements I will be delighted. A wooden case 5 in. by 2½ in., having a round hole in front, closed with a piece of thin wood, to act as a diaphragm; two small blocks of carbon, with a small cavity scraped in the centre of each; a pencil of carbon, pointed at each end to fit into the cavities in the carbon blocks. One of the carbon blocks is fastened with cement to the diaphragm, the other to a piece of springy steel or brass, which is itself fastened in the bottom of the wooden case. The adjustment is made by a brass screw in the back of the box. Wires are fastened to the carbon blocks, and carried to binding screws, which may be placed in the top or back of the box as thought convenient. The sketch is given full size, but the sizes are not very important. There are a great many transmitters, some of them very intricate in the arrangements of the several parts. The one which I have given is just the opposite; it is very simple and easily made, and, providing the batteries and other things are in good order, it will do its work very satisfactorily.—W. D.



Microphone Transmitter for Telephone.—A, Wooden Case; B, Thin Wood Diaphragm; C, C, Small Blocks of Carbon; D, Pencil of do.; E, Adjusting Screw; F, Spring; G, G, Wires to Binding Screws.

American Clock Spring.—FACTORY HAND (*Brockholes*).—The spring might be made soft at the end by heating to a red heat and allowing to cool, then drill or punch. There is no need to rivet to the arbor, as in winding up; the rivet head, or more properly speaking the arbor hook, will catch in the hole and will hold it quite right. But after you have done it I do not think you will find it stand winding up. The best and simplest way is to get a new spring; it will only cost a few pence—perhaps 9d. at the most—and it will save you trouble. You may get the spring at Grimshaw and Co., 35, Goswell Road, or J. Hunt, 21, Ironmonger Street, St. Luke's, Clerkenwell. Take or send old one for pattern.—A. B. C.

Stains.—A. W. B. (*York*).—Dragon's blood is soluble in methylated spirits, so that you can either make a stain by dissolving a sufficient quantity and diluting afterwards with water, or you can dissolve it in the polish or varnish you may elect to use. With regard to your second question, I should certainly not think it worth while to take the trouble of polishing any piece of pine wood after staining it with dragon's blood. I presume you intend to use this as a mahogany stain, but the colour is far too fiery, and I cannot recommend you to do so. You will get a brilliant red, which is anything but a mahogany colour, though often supposed to be so. If you want a good mahogany stain for your chest, make it up of Bismarck brown, which may either be dissolved separately, or in the varnish or polish. It is a very powerful pigment, so that you must be careful not to use too much of it. As much as will stand on a shilling-piece will probably colour a pint of polish sufficiently for your purpose, though you can add more or less according to the intensity desired. Strain through muslin before using. To get a really nice dark rich mahogany colour on your chest, you cannot do better than stain it with weak walnut stain, and then finish with some of the red polish prepared with the Bismarck brown. Of course you are aware that polishing is more troublesome and difficult than varnishing, but that when properly done the appearance is far superior. I must confess that it seems rather an unnecessary degree of refinement to French polish a tool chest, but for your own purposes naturally you must be the best judge.—D. A.

Gilding Book Edges.—F. J. J. (*Macclesfield*).—There is no special recipe for gilding book edges. I will give a description of the process in common use, and if the querist follows it out I think he will be able to do his work satisfactorily. First then screw the book up as tight as possible in the lying press, between gilding boards, and scrape perfectly smooth with a steel scraper. Then take a wet sponge with a little bole, and blacklead and rub it over the edge, and brush it dry and burnish it with the agate. The bole gives a deeper appearance to the gilding, and if any cracks should be in the edge they will not be so readily observed. The size (which should be one part white of an egg to three parts water) must now be applied evenly with a large flat camel-hair brush, and the gold immediately laid on. After the edge has become perfectly dry it should be rubbed down, and any defects remedied. After this, burnish the edge until it is perfectly clear all over. The best gold leaf is what is known as "deep." The cost of a book is 1s. 3d. It requires a great deal of practice to become a good gilder.—G. C.

Brass Lacquer.—A. H. (*Hull*).—There is no lacquer that will make iron look like brass. Perhaps some kind of bronze would suit your requirements. If the iron articles are gas fittings, for instance, clean them well with sandpaper, and wash in strong soda and hot water. Dissolve ¼ oz. shellac and ½ oz. gum benzoin in one pint of methylated spirits, by putting the ingredients in a bottle, and shaking often for two days. Then let it stand for two days, and pour off the clear liquid into another bottle. Now get some bronze green, and mix a small quantity with some of the above lacquer, and paint the iron work, which should be warmed; when dry give another coat. If there are any ornaments, touch them up with a little of the lacquer, and before the latter is quite dry, with a camel's-hair brush dipped in dry gold bronze powder, slightly gild the ornaments; after a few hours the work may be varnished. In reply to M. A. J. J., whose question appears in the same letter, indiarubber may be dissolved in any of the following solvents:—Bisulphide of carbon, benzine, benzoline, chloroform. It is not quite clear from your letter whether you require to cast articles of indiarubber in moulds, or to make indiarubber moulds. If the latter, apply successive thin coats of the indiarubber solution to the article to be reproduced, etc., and thus build up the mould. This, however, is suitable only for very fine and delicate work, and it is impossible to cast articles of pure indiarubber.—OPIFEX.

Ornamental Work in Lead.—A. K. (*Aberdeen*).—The article you desire to make is, I take it, of the fancy or purely ornamental kind as distinguished from the practical or useful. This being so, your choice of subjects is large, and the selection must depend rather on your own taste and judgment than on external advice, though I must say lead does not seem a very suitable material in itself. You are doubtless aware that it may be used instead of brass for repoussé work, and also for spun metal work. It might also be used instead of iron in imitation of the now fashionable wrought iron fancy articles, such as candlesticks, etc. etc. I cannot, however, advise its use for this purpose as savouring very much of sham production, and imitations are seldom commendable, albeit often ingenious. Perhaps a better way of making something ornamental, and not inconsistent with the material, will be to arrange the lead in form of conventionalised foliage on a wooden foundation. If, however, it is to be artistic work, see that you do not endeavour to get the appearance of some other material. For example, do not try to make your work resemble a piece of carving. Lead has properties of its own; remember these, and let the work show that lead is the material, instead of endeavouring to make it look like something else. I fancy I have heard of lead being used in this way in connection with Jacobean strapwork. If, as I think, you are a plumber, and want to show specimens of your skill at an exhibition, why not prepare something which shall show your proficiency in the recognised lines of plumbing? What you ask seems akin to a painter asking what subject he shall choose, and how it is to be treated, instead of bringing his own artistic perceptions to bear. I know of no book on the subject.—D. A.

Horse-power.—COLLIER (*Bolton*).—The horse-power of an engine is equal to the area of piston in square inches, multiplied by the effective pressure of steam per square inch in lbs., multiplied by length of stroke in feet, multiplied by number of strokes (that is, twice the number of revolutions per minute), divided by 33,000. The effective pressure is the mean pressure during the stroke, less the back

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pressure. Taking your figures, and assuming the pressure you give, 60 lbs., to be mean effective pressure, the power will be—

$$\underbrace{36\times36}_{\text{area of piston}}\times\underbrace{0{\cdot}7854}\times\underbrace{60\text{ lbs.}}_{\text{effective pressure}}\times\underbrace{6{\cdot}5\text{ ft.}}_{\text{stroke}}\times\underbrace{2\times28}_{\text{No. of strokes}}\div33{,}000=\underbrace{673{\cdot}6.}_{\text{horse-power}}$$

One horse-power is taken as equal to 33,000 foot-lbs. per minute, so we have a short rule. Horse-power equals piston area in square inches, multiplied by piston speed in feet per minute, multiplied by mean effective steam pressure in lbs. per square inch, divided by 33,000.—F. C.

Bending Ivory.—W. J. M. (*Liverpool*).—You can bend ivory slightly by immersing it in boiling water until it gives a little, then clamp it firmly in the position required, and let it get cold. To soften it entirely, a solution of phosphoric acid and water is used; it is immersed until it loses its opacity somewhat; when washed and dried it becomes hard again. But this causes some alterations in it. I do not know what, so be careful with it. I know the first is all right, but then I did not have to bend it much.—H. S. G.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Boot and Shoe Making.—SHOEMAKER (*Somerset*) writes in reply to BOOTS AND SHOES (*Farnworth*) (see page 284):—"I will endeavour to furnish him with the information he requires, and perhaps I shall best accomplish this by describing how I should finish a soleing job. I presume he has a shoemaker's knife, as he 'knows a little of repairing.' I should commence by paring the new sole evenly and in shape with the boot; then rasping it with a rasp, which can be obtained at a leather and grindery seller's for 8d., 8 in. long—this, I think, a convenient size. After this a buffer is used. This can be made from almost any odd piece of steel such as a broken house knife or corset steel. The way to sharpen it is to file it to a semi-circular shape at one or both ends, also file it thin, not thin enough to cut as a knife; then with the back of the shoemaker's knife or awl rub it along the edge with a good pressure; this will have the effect of turning an edge, which does the scraping. Then sandpaper the edge (grasp the sandpaper in such a manner that the thumb will do the work). A burr will now be seen on the bottom. This must be pared off; then with smooth side of the rasp file in an outward direction, taking care to get the edge of sole the desired substance all round. Now take some paste, and spread on the edge, wiping off with a rag and spittle; this makes it smooth. Now ink: ordinary writing ink will do if no other is at hand; this must be allowed to dry, after which is the ironing process. A single iron is used for this work; it is so called because it has only one guide, consequently can be reversed to sole and upper side, and does away with the necessity of a multiplicity of irons. This can be bought at a leather and grindery seller's at a cost of from 4d. to 1s. Black heelball is ironed in to give polish. If the soles are riveted on, the rivets may be filed with the smooth side of the rasp. Now buff (scrape) the bottoms with a buffer made to cut along the sides in the same manner as described for edge buffer; after this freely use No. 1½ sandpaper. If desirable to make what is known as 'a damped down bottom,' an amateur may have some yellow soap (of good quality) dissolved in water till it forms a semi-liquid; use a clean piece of flannel to damp it with. After all the sole is covered, wipe off all that can be wiped off with a dry place in the flannel; allow this to dry. It will now depend on the skill and the quality of the leather whether the bottom is of a good colour or not. Now put some white heelball on the (bottom side) edge, and when the iron is hot melt this so as to make a brown mark on the bottom. Now rub off all heelball with a piece of cloth, and the job is finished. I am afraid I have used too much of your valuable space, but I have tried to act out the 'golden rule.' I wish WORK a long and prosperous career. I have taken it in from the first, and have persuaded (successfully) others to take it, and when I met one of them one day, I asked him how he liked it; his reply was 'very well.'"

Lathe Work.—T. R. writes in reply to a READER OF WORK (see page 382):—"I am inclined to think it will prove a somewhat difficult job to adjust compound rest on an ordinary lathe to be absolutely certain that a perfect fit will be the result without adjustment in taper work. Where a vernier exists at the base of tool slide, the latter may be approximately set by clamping at the required number of degrees to right or left of zero. Another method consists in using a right and left hand template cut to the angle required, secured with its base resting against the face of the face-plate to a bracket attached to the latter on a radial line with centre of lathe spindle. I always prefer where practicable to do the boring first. Some lathes are fitted with a screw at base of sliding headstock, which is very useful in tapering work between the centres, rendering adjustment easier than by slackening nuts on tool-slide. As the leading screw is ¼ pitch, this fraction must be ignored in cutting odd threads as 7 per inch, and the saddle must always travel a certain number of whole inches from the point at which the nut is dropped into gear to the point where the lathe is stopped, and saddle run back to starting point again. You do not state the length of screw to be cut; but say it is 4¼ in., then the distance travelled by the saddle must not be less than 5 or 6 in. (no fractions, mind) from starting to stopping. Chalk the lathe bed and the top of wheel on leading screw to indicate the exact position for stopping and starting. In the case of the 4½ threads per inch, this is equal to 21 threads in 5 in., therefore the saddle must run 5, 10, 15, 20 in., or some other multiple of 5 in., as the case may be, before stopping the lathe to run back."

Carriage Paint.—W. P. writes in reply to W. W. W. (*London, S.E.*), No. 28 in "Shop":—"Although you do not state whether the rose pink fades lighter or darker, the following, I think, will meet your requirements. Get some black carriage japan and grind some rose pink in it, then add a very little of Indian or Tuscan red until you get the required tint. To make a better job you might glaze it over with lake at the last coat."

Mounting Calendars.—R. R. & Co. (*Newcastle upon Tyne*) write in reply to AN OLD GLUER (see page 413, "Shop"):—"Referring to above query, we have a machine in use for gluing sticks for mounting calendars. It is simply an enlarged glue pot made in an oblong shape with water jacket under it, but instead of using a brush having a wooden roller 5 in. diameter resting in the glue with spindle resting in slots at each end with handle at one end to revolve it, the water being heated below with gas, a pipe with holes along being underneath it, the pot should be long enough to admit a roller 2 or 3 in. longer than the longest stick to be glued. The roller (wood) is cut in grooves at distances of 1 in. apart, it not being necessary to glue the sticks all along, saving glue. When the roller resting in glue is turned round the sticks are simply placed one at a time against it, and they take the requisite supply off the roller, which is turned round again as soon as more glue is required. One girl or man can work at each side by placing it in the centre of a bench."

Simple Incubator.—B. A. B. (*Hampstead*) writes in reply to B. F. (*Liverpool*) (see page 302):—"A simple incubator can easily be made, but unless B. F. is prepared to give great attention to the working of it, or can invent or copy a contrivance to prevent the heat fluctuating, he will find it nearly useless. Perhaps he may (if an amateur) copy one of the patented devices; for instance, a small receptacle is made of *thin* metal fitted with a liquid which boils at 103 deg. F., therefore expanding the flexible walls of the receptacle, and

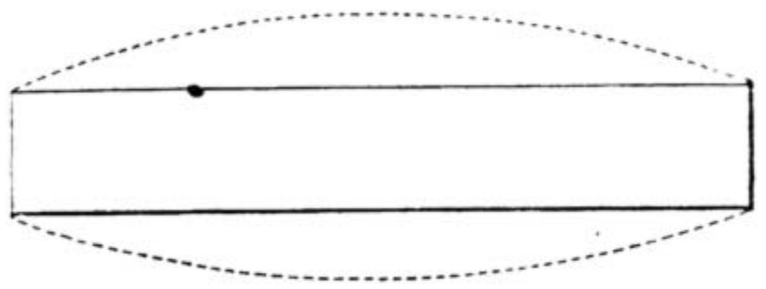
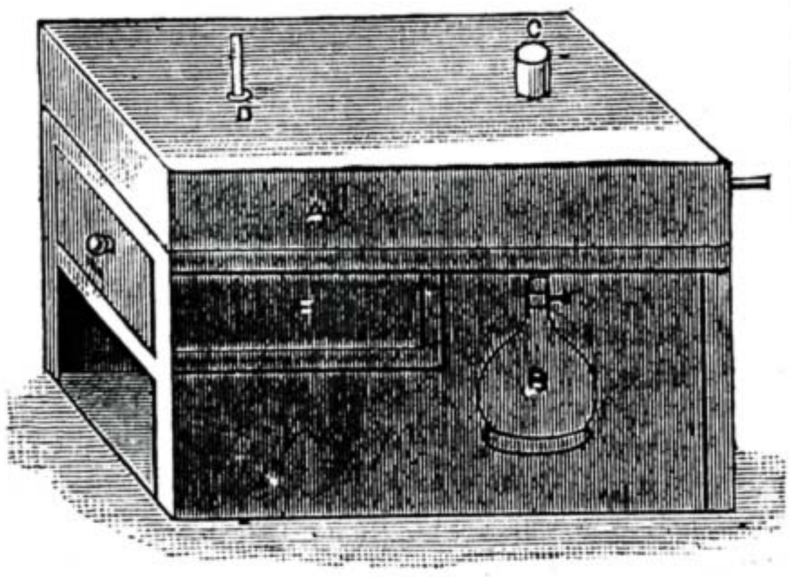


Diagram showing (exaggerated) expansion of receptacle.

by levers diverting the draught from the lamp; or he might get an electric bell and a special thermometer to make contact at 103 deg. F., so ringing a bell to warn him to reduce the heat. Supposing, however, he has mastered the regulation of the temperature, the rest is easy. Let him make a wooden drawer for the eggs with a frame to carry it. Let the eggs rest on a good thick layer of straw, for some ventilation is needed. The drawer need not be very deep, say, 3½ or 4 in. inside, and had better be lined with tin or zinc, as a little water must be given to moisten the straw from



Simple Incubator—A, Tank or Boiler; B, Lamp; C, Chimney; D, Thermometer; E, Drawer for Eggs. The whole, except front of drawer, to be enclosed to keep in the heat.

time to time. The heat must be applied from the top, and the tin box made into a shallow cover to the drawer case. Let this cover project either at back or side, and have a lamp as a source of heat. There had better be a tube through the boiler, with a movable damper to close it. When open the heat will pass away; when shut will play on the bottom of boiler. Have a thermometer on top of boiler, and then enclose the whole with a wood casing to prevent radiation and loss of heat, admitting a view of the thermometer either by having thermometer upright, the stem passing through a hole in the casing, or lying horizontally with a piece of glass let into the top of casing. There had better be a small ventilator in the drawer front, near the bottom, as air is needed especially during the latter part of the process of incubation."

Fretwork and Carving.—B. A. B. (*Hampstead*), in reply to W. M. M. (*Glasgow*) (see page 446), writes:—"I advise you to write direct to Zilles & Co., because that firm certainly know best as to what patterns they keep in stock, and the prices they charge. A fuller answer would be an advertisement."

Removing Ink Stains.—J. C. (*Ryde, I.W.*) writes:—"In reply to LITTLETON (*Worcester*) (see page 366), ¼ oz. of citric acid diluted in 4 ozs. of water will remove all traces of ink, but not printer's ink."

Copying Tracings.—L. M. (*Putney*) writes in reply to PHOTO (*Chester*) (see page 366):—"I don't know of any process in which tracings can be copied in black and white by means of gallic acid, but I give a formula from the *British Journal Photographic Almanack* for 1889, which may suit PHOTO (*Chester*). Make a solution of gelatine, 1 part; water, 15 parts; warm it till dissolved, then well mix with it Indian ink or any pigment desired. Pour it while warm and fluid into a dish, and float paper upon it, and let it dry spontaneously without heat, and away from dust. When dry immerse it in the following solution:—Perchloride of iron, 240 grains; tartaric acid, 72 grains; water, 5 oz. Let it remain two or three minutes, and dry it in the dark. Print under the tracing in the usual way. Develop by immersing it in warm water. The light causes the parts not protected by the lines to become soluble in warm water. The lines are thus rendered black or coloured on a white ground."

Fretwork Picture Frame.—H. B. (*Maida Vale*) writes in answer to AMATEUR (*Belfast*) (see page 510):—I shall be pleased to send him a very effective pattern for above if he will send me his address."

Pill Making.—G. A. B. (*Old Kent Road*) writes in reply to J. C. (*Carlisle*):—"Being a subscriber, and looking over WORK (No. 31, p. 494), asking, through your valuable paper, if any of your numerous readers could inform J. C. (*Carlisle*), or suggest any tool or machine for pill making, I beg to say I am employed by Mr. G. W. Niblett, of 26, Rainbow Street, Southampton Street, Camberwell, S.E., who will be most happy to furnish any requirements in same, as he is a manufacturer with every improvement connected with pill-making machinery."

Cleaning Engravings.—H. L. B. writes in reply to IVOR (*Bradford*) (see page 494):—"What a silly thing to do; of course the lime would act on the zinc. Todd's Victory enamels (Todd & Co., Hull) are recognised by practical men as the best things of their class, as they are a little better than ordinary paint mixed with varnish. Some of their bath enamel or the Chez-Lui bath enamel might stand the lime. But the zinc would require three coats, and the enamelled surface would then have to stand at least three weeks to get quite hard. You should not have lined the wooden tray with anything, but coated it with best shellac varnish. We use this in photography for our large trays, and find it waterproof and acid proof."

Pill-Making Machines.—H. L. B. writes in reply to J. C. (*Carlisle*) (see page 494):—"These may be had from Arnold & Sons, 35 and 37, West Smithfield; or, Burgess, Williams, & Francis, 101, High Holborn, W.C., London; or, Maw, Son, and Thompson, 7-12, Aldersgate Street, E.C."

Carriage Paint.—H. L. B. writes in reply to W. W. W. (*London, S.E.*) (see page 446):—"You must use good colours in carriage painting, and pay a good price for them, or your work cannot stand. I should think brown lake would be about the shade you want, it is not very expensive; try Simpson & Co., London Road, Southwark, for this colour, and say I sent you to them for it. For common work a deep purple brown might do, darkened a little with vandyke. For a purple colour mix white lead, Prussian blue, and vermilion. For dark chestnut, mix light red and black, and use red ochre when you require to lighten colour. For chocolate, mix vegetable black and Venetian red."

Ink for Posters.—SMILING SMUDGER (*Manchester*) writes in reply to A. J. (*Ilkeston*) (see page 494):—"I have tried several methods of poster writing, but have found the best and cheapest, and certainly the cleanliest and handiest, for an amateur who only occasionally does bill writing, to be ordinary oil paint, easily procurable in tins, mixed with about four times the same amount of benzoline. Use a long-handled round fitch to outline with, filling in with small pound brush. Any colours, such as vermilionette and lemon chrome, not always to be obtained in tins, you may obtain in a powder, or ground in oil; when mixing them add about a twentieth part of oil. Tack the whole of your bill, if possible, to a good plaster or boarded wall, and be careful not to splash the lower portion. I have written some very effective calico banners by this method, besides large pictorial posters, 25 ft. by 18 ft. It will serve equally well for tickets, only not quite so thin. Heywood, Deansgate, Manchester, supply a splendid paper for this kind of work, called the 'Mammoth,' size 63 in. by 49 in., price 1s. 6d. the quire."

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Varnish for Drawings. — A. W. (*Croydon*) writes in reply to A. M. (*Glasgow*) (see page 510):—"First size over drawings with a weak solution of French gelatine to be obtained at any grocer's or chemist's for about 2d. per ounce; then, when dry, proceed to varnish with the following mixture:—Take equal parts of Canada balsam and turpentine; dissolve by gentle heat in a wide-mouthed bottle, and apply with a broad camel-hair brush."

Ink for Posters.—H. L. B. writes in reply to A. J. (*Ilkeston*) (see page 491):—"The ordinary printers' inks, diluted with paraffin or benzine, are all that is used in poster painting. I am engaged by the Editor to write on this novel subject, and shall commence as soon as time permits, which I hope will be shortly."

Parchment Mounting and Stains.—In No. 31, p. 491, MITRE (*Hanwell*) asks for information on the above. Parchment requires no special treatment for mounting. If you wish to mount your certificates on cards for framing, lay them out on a piece of paper (to keep the table clean), and paste them well with good flour paste, not too thick, using rather a large brush, and going over the parchment as quickly as possible. When carefully pasted, lift the parchment, and lay it upon the cardboard, place a sheet of paper over it, and rub it well down with both hands. There is no need for damping, you will find that the paste will make the parchment quite damp enough. About the stains, however, you should have been more explicit. Some stains may mean much or little, and some stains would require a different mode of treatment from others for their removal. However, you might try oxalic acid and water, or rather water to which a little oxalic acid has been added. I intend to go into the subject of mounting by-and-by if the Editor can find room for this subject.—G. C.

Patent.—PATENTEE (*Leeds*) writes in reply to MINERVA (see page 446):—"'Those who thoroughly understand patents are well aware that this provisional protection is in reality a very questionable monopoly, and that no action for infringement would lie against any one for pirating an invention only provisionally protected.' The above remarks, which appeared in your paper on the 28th inst., are altogether misleading. Section 14 of the Patents, Designs, and Trade Marks Act, 1883, states:—'Where an application for a patent in respect of an invention has been accepted, the invention may, during the period between the date of the application and the date of sealing such patent, be used and published without prejudice to the patent to be granted for the same, and such protection from the consequences of use and publication is in this Act referred to as provisional protection.' Section 15 continues:—'After the acceptance of a complete specification, and until the date of sealing, the applicant shall have the like privileges and rights, as if a patent for the invention had been sealed on the date of the acceptance of the complete specification, provided that an applicant shall not be entitled to institute any proceedings for infringement unless and until a patent for the invention has been granted to him.' Therefore it is clearly evident to any one of ordinary comprehension that not only is the invention fully protected by the provisional specification from the date of that document up to the date of sealing of the patent (provided, of course, that a complete specification is lodged and accepted within the prescribed time), but proceedings for infringement can be instituted for any piracy of the invention occurring within the period covered by the dates of the provisional protection and acceptance of complete specification and sealing of the patent. Most patent agents of any repute advise that it is preferable to lodge merely a provisional specification with the application for a patent, because on a complete specification being lodged and accepted it is advertised, and must be open to public inspection for two months to allow any one to oppose the grant of the patent; but a provisional specification is not open to public inspection during the term of provisional protection—*i.e.*, during the nine months or until the complete specification is lodged and accepted. Another very important reason why it is more advisable to lodge a provisional specification at first is that a complete one becomes public as soon as it is accepted, and if the inventor has not before then applied for his foreign patents he must run the risk and danger of being forestalled by some one patenting his invention before him in those foreign countries where the first applicant can usually obtain a patent, whether he be the inventor or not. Another good reason for lodging a provisional protection first is that if the inventor has not sufficiently perfected his invention in all its details, so that a full and complete specification and drawings may be lodged, he will have nine months in which to fully develop and complete it. It would therefore seem desirable for your editorial department to carefully examine any remarks intended for publication, so as to expunge all mischievous and inaccurate statements, if you wish to maintain the reputation of your paper."

Illuminating.—FAL writes in reply to H. C. (*Lincoln*) (see page 318):—"Vellum, not parchment, should be used for illuminating upon, the latter being quite unsuited for the purpose. Vellum is a most beautiful material, and admirably adapted for illuminations, though care is required in working on it, as it is almost, if not quite, impossible to erase any marks when once made. Ordinary moist or cake colours are the best things to use, assuming, of course, that they are obtained from a first-class house. I use Winsor and Newton's or Roberson's generally with shell, and sometimes leaf gold, and have always found these highly satisfactory. I hardly know what you mean by 'brilliant.' Of course they can be made brighter by giving them a coat of gum after the colours are dried, but I do not think the result would be improved by it. You should, by all means, study the illuminated manuscripts in the British Museum, but if this is impossible, if you will state exactly what you want to know I will do my best to tell you. Some years ago I invented a very simple method of stretching vellum, so as to avoid the cockling which wetting it entails. At this moment I am too much engaged to give the particulars of it, but if you would like to have them, and the Editor is agreeable, I would send a sketch and description to our 'Shop' in a day or two. I may just say that the plan answers perfectly."—[By all means send description and sketch of your plan.—ED.]

Plan for Stall for Covered Market.—B. A. B. (*Hampstead*) writes in reply to J. T. (*Middlesbro'*) (see page 491):—"The conditions laid down are that it shall shut and lock up; to secure this, and to utilise the doors for displaying goods upon, it will be advisable to make the front in four sections, two of which are fixed, and help to form the framing, and two hinged to the outer fixed sections; the ends make of two strong frames without panels, having instead a pair of glass cases revolving on centres fixed in middle of inner edges of top and bottom rails, having bolts inside to fix glass cases, either with their solid backs outside

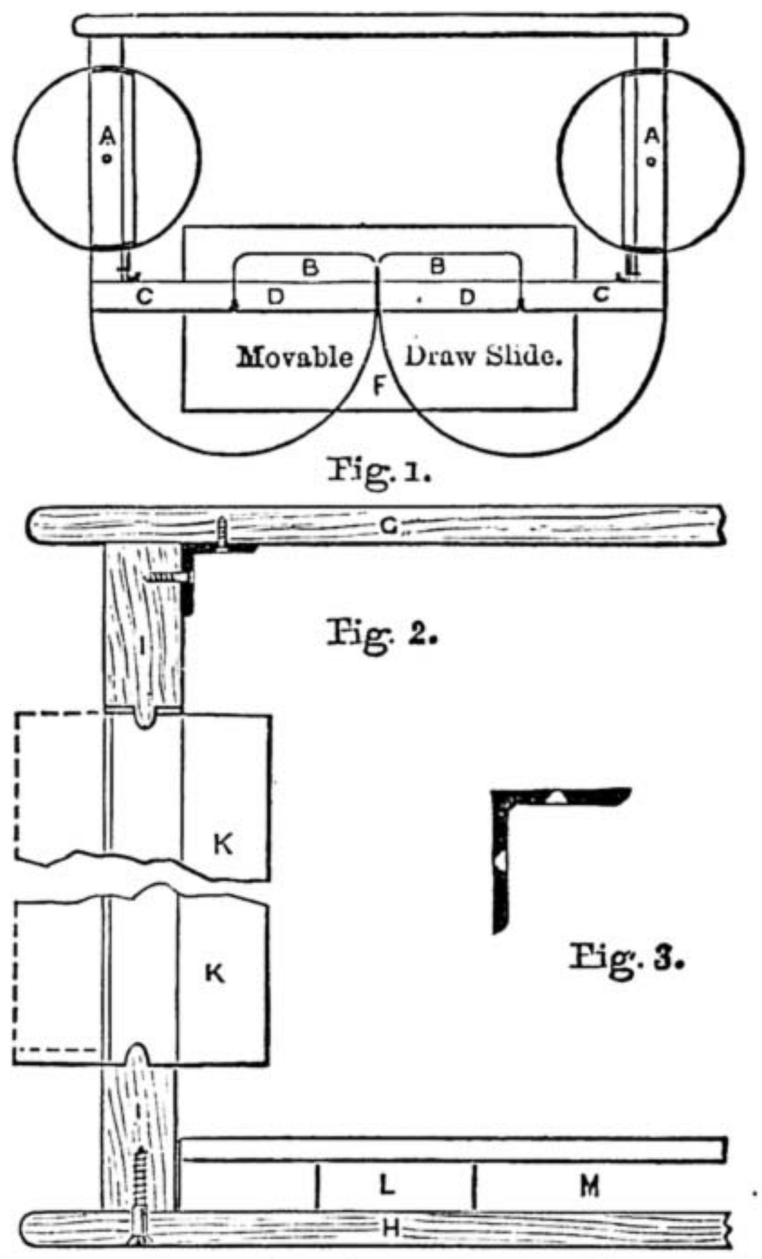

Fig. 1.

Fig. 2.

Fig. 3.

Stall for Covered Market. Fig. 1.—Plan: A A, Cases to revolve; B B, Shelves or Cases; C C, Fixed; D D, Hinged. Fig. 2.—Sections of Stall: G, Roof; H, Bottom; I, End; K, Case; L, Ledge; M, Slide. Fig. 3.—Iron Angle Pieces at intervals, important. Not to scale.

or their glass fronts outside as may be required. The bottom I should make of floor board ledged and screwed, having between the ledges a sliding board to draw out in front like a counter flap; over the ledges a false bottom to enclose flap; the back could cheaply be made of match lining not less than ¾ in. thick; top of same, covered outside with prepared canvas such as coach builders cover carriage roofs with. The whole of inside would be best painted white to obtain more light. I do not know if the stall is to go on wheels; if so, some modification might be necessary for what I have called the front, but which, if made as a vehicle, would of course be one of the sides. The whole of the erection could be done with screws or bolts and nuts, and the only joinery would be the glass cases and the end frames; the bottom screwed to ends; ledges of back fitted and fixed thereto; roof screwed from below through angle plates all round at short distances apart."

Ivory Walking Stick.—J. W. (*Liverpool*) writes *re* P. P.'s (*Withington*) reply to W. A. (*Hanley*) (see page 510):—"I will give simple opinion, as I think it will be an improvement—that is, to drill the ends, as P. P. advises, but tap a thread, and screw a bit of wire, level ends nice and flat, and screw wire in each end; that will pull it up to such a joint that it will not be seen."

Trade Notes and Memoranda.

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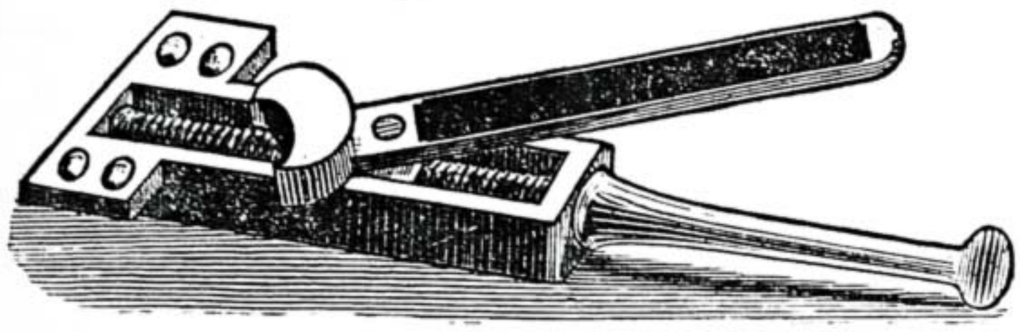

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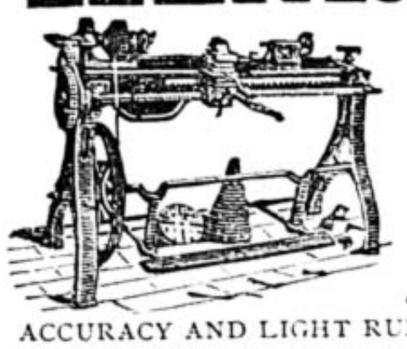

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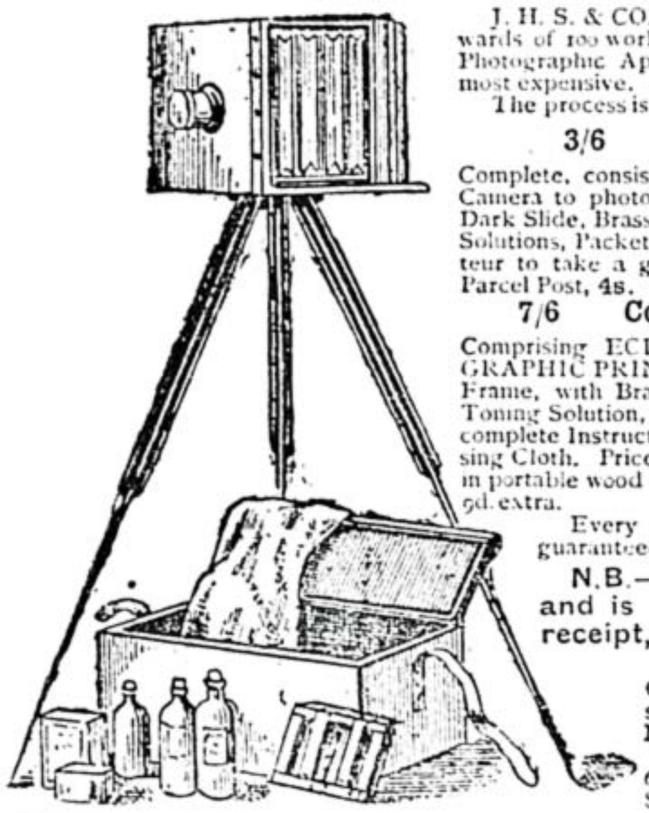

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